

AN ANNOTATED REVISION OF THE GENUS *SCHIZOCHILUS* SOND. (ORCHIDACEAE)

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ABSTRACT

The genus *Schizochilus* (Orchidaceae) is revised. Ten species and three subspecies are recognised. Two new species are described: *S. lilacinus* and *S. crenulatus*. The history, morphology and systematic position of the genus are briefly reviewed, and the available information on the habitats of each species is compiled. Two species are illustrated.

'N GEANNOTEEERDE HERSIENING VAN DIE GENUS *SCHIZOCHILUS* SOND. (ORCHIDACEAE)

UITTREKSEL

Die genus *Schizochilus* (Orchidaceae) word hersien. Tien spesies en drie subspesies word erken. Twee nuwe spesies word beskryf: *S. lilacinus* en *S. crenulatus*. Kort aantekeninge oor die geskiedenis, morfologie en die sistematiese posisie van die genus word gegee, en die beskikbare informasie oor die habitat van elke spesies word gegee. Twee spesies word geïllustreer.

INTRODUCTION

Schizochilus Sond. is a genus of 10 species. Despite the small size of the plants (rarely larger than 300 mm), the bright white and yellow flowers and the elegantly slender plants with nodding flower-heads make it one of the most beautiful groups of southern African terrestrial orchids.

The taxonomy of this genus has been in a state of confusion since the treatments by Rolfe (1912) and Schlechter (1921). However, these taxonomists ought not to be judged too harshly: *Schizochilus* shows extensive convergent evolution. The most common species (*S. zeyheri*) has a wide range of variation that segregates partially into geographic forms; and the flower morphology is remarkably uniform throughout the genus. From the limited herbarium material available at that time and, in Rolfe's case, the absence of field experience, no satisfactory treatment was possible. Unfortunately, Schlechter also created some nomenclatural confusion by describing numerous species and by misinterpreting some of Rolfe's concepts.

This study is an attempt at a biologically satisfactory classification, in which species are regarded as evolving biological entities, the products of still active processes. These processes concern adaptations to habitat and to pollinators. So, although my species conform to the traditional norms as set out in Davis and Heywood (1963), habitat, flower colour and phytogeography were extensively

taken into account. To extend the data base of these non-traditional characters, extensive field work was done in the summers of 1976–77 and 1978–79. Populations of all species except *S. lepidus* Summerh. and *S. ceciliae* Rolfe ssp. *ceciliae* were investigated.

It is unfortunate that the cultivation of the orchids still presents so many problems, as biosystematic studies—especially with regard to the fertilisation systems—could reveal valuable and interesting information on the adaptive strategies and survival capacities of these taxa.

HISTORICAL REVIEW

The genus *Schizochilus* Sond. was described in 1847, with *S. zeyheri* as the only species. During the next 60 years, only two more species were added: *S. bulbinella* (Reichb.f.) H.Bol. and *S. gerrardii* (Reichb.f.) H.Bol. But during this period the status and affinities of the genus were under constant review. Most taxonomists did not accept it as an independent genus. Reichenbach (1867) included it in *Brachycorythis* Lindl., Schlechter (1895) in *Platanthera* Rich. and Kraenzlin (1898) in *Gymnadenia* L.C.Rich. Initially the genus had been allied to the *Disa-Satyrium* group, but Schlechter linked it to the *Gymnadenia* group, an opinion that is still widely followed. After Rolfe's revision (1912), *Schizochilus* has generally been accepted as an independent genus.

From 1905 to 1925 the number of described species in the genus increased from three to 26. Both Rolfe and Schlechter described every variant and local facies as a new species, of which most are based on single collections. Of the 13 new species, which Schlechter published in 1921, only one is upheld in the present revision, and that with subspecific status.

Although Schlechter's (1921) revision has been generally followed in herbaria, the need for a critical revision has long been realised (Dyer, 1944; Schelpe, 1966).

THE SYSTEMATIC POSITION OF *SCHIZOCHILUS*

Schizochilus belongs to the Orchideae (sensu Airy Shaw, 1973). Pfitzer (1889) placed the genus in the "Monandreae-Ophrydinae-Satyriaceae" which included *Disa*, *Satyrium*, *Brachycorythis*, *Schizochilus* and *Platycoryne*. As sole differentiating character the angle between the anther and the ovary (acute in this group, obtuse in all other Ophrydinae) was mentioned.

Schlechter (1895) allied *Schizochilus* with the *Gymnadenia-Platanthera* group, on the basis of lip structure, general tepal orientation and rostellum structure. He diagnosed the group as: lip ligulate or trilobed, usually spurred; sepals and petals sub-equal, more or less ovate; anther relatively simple, erect; stigma flat or concave, usually vertical in the mouth of the spur; rostellum simple and small. This system was followed by Kraenzlin (1898), Rolfe (1912), Schlechter (1921, 1927) and Summerhayes (1968).

Senghas (1973) elaborated Schlechter's (1927) system, describing three tribes, of which the Orchideae are then subdivided into five subtribes. *Schizochilus* is included in the Platantherinae, together with *Brachycorythis*, *Platanthera*, *Gymnadenia* and *Holothrix*. The group is characterised by (a) a single concave stigma, and (b) by the glands being naked, not enclosed by bursiculae. The Platantherinae are further divisible into two subgroups, on the basis of rostellum structure. The *Gymnadenia* group is characterised by a rostellum with a central lobe that extends between the anther cells (*Schizochilus* belongs to this group). The *Platanthera* group does not have such a well-developed central rostellum lobe.

The differentiation of *Schizochilus* from its allied genera has consistently caused problems. Characters most frequently used are: (a) flower colour yellow or white (Kraenzlin, 1898), (b) flowers not resupinate (Kraenzlin, 1898), (c) presence of calli at the throat of the spur (Schlechter, 1921; Senghas, 1973), (d) inflorescences nodding (Schelpe, 1966), (e) tubers testicular (Senghas, 1973), (f) petals half as long as the sepals (Senghas, 1973; Rolfe, 1912) and rostellum trilobed (Schlechter, 1921). Flower colour and nodding inflorescences separate *Schizochilus* from the European *Nigritella* L.C.Rich., and non-resupinate flowers, testicular tubers and nodding inflorescences from *Gymnadenia*. Several species of *Schizochilus* have subobsolete or no calli, and the three-lobed rostellum is typical of the whole *Gymnadenia* group. *Schizochilus* is best differentiated by the following characters: tubers generally testicular, inflorescence usually nodding; petals ca. half as long as the sepals; lateral sepals suboblique; lip trilobed, the central lobe invariably longer than the lateral lobes; flowers white or yellow or pale mauve, not resupinate.

PHYTOGEOGRAPHY, ECOLOGY AND SYSTEMATICS

By comparing the phytogeographical, ecological and morphological patterns shown by the taxa, an overall hypothesis on the evolutionary relationships within the genus *Schizochilus* can be constructed. This hypothesis is implied in the ranks and delimitation of taxa and in the sequence in which they are arranged.

Most of the genus occupies the Afro-montane Zone, as defined by White (1976, 1978a). Only *S. zeyheri* transgresses occasionally into Tongaland-Pondoland Region (White, 1976). Four centres can be recognised in the distribution of *Schizochilus*. These do not agree with the centres and intervals proposed by Weimarck (1941), who recognised a single Drakensberg centre and an interval between the Mlanje and Rungwe Subcentres. The major phytogeographical patterns are indicated in Figure 1.

In the Afro-montane Zone *Schizochilus* occurs in grasslands and rock flushes and on rock ledges. In the Guinea-Congolian Zone it occurs in edaphic grasslands. Within the Afro-montane Zone there is both an ecological as well as a geographical differentiation among species. The geographical differentiation can be between centres and in three cases, within centres. Ecological separation within a centre is

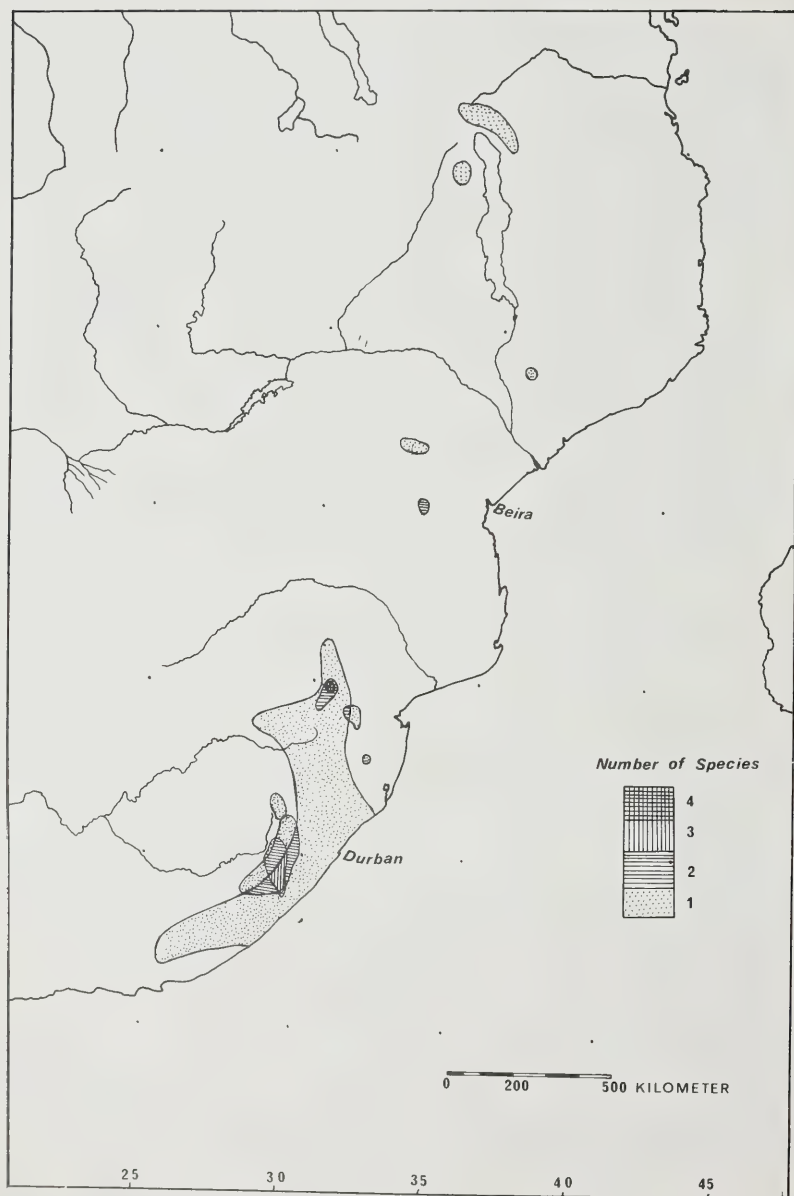


FIG. 1.
Distribution of the genus *Schizochilus* Sond., showing the concentration of species in the Drakensberg

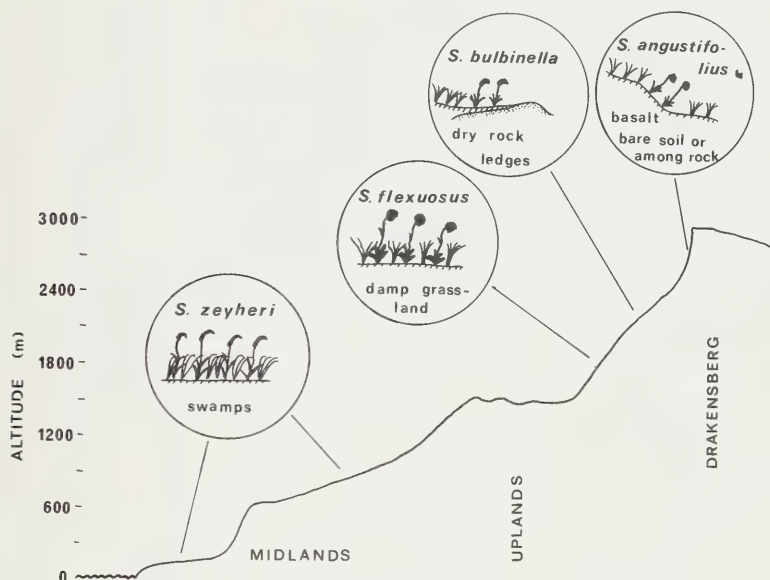


FIG. 2.

Ecological relationships among the species in the Natal Drakensberg and coastal areas

best indicated by a direct diagrammatic comparison of the habitats of each species. A comparison of habitats between centres is rather difficult, as no quantified habitat descriptions exist.

The habitats of the species of the Natal Drakensberg Centre are compared in Figure 2. Taxa separate altitudinally, but this altitudinal gradient probably reflects a complex of other environmental factors. Where altitudinal overlap of species occurs, (*S. bulbinella* and *S. flexuosus*, i.e. at Bushmansnek), the taxa inhabit different habitats. Note that the high-altitude taxa (*S. bulbinella* and *S. angustifolius*) are separated eco-geographically.

In the Transvaal Drakensberg specific habitats appear to separate more or less on a moisture gradient (Fig. 3). At Graskop *S. zeyheri*, *S. crenulatus* and *S. cecilia* ssp. *transvaalensis* were found in the same swamp, but each in its own habitat. Populations were not mixed. On Long Tom Pass *S. cecilia* ssp. *transvaalensis* and *S. lilacinus* were found in the same locality. *S. cecilia* ssp. *transvaalensis* and ssp. *culveri* appear to be geographic vicariants.

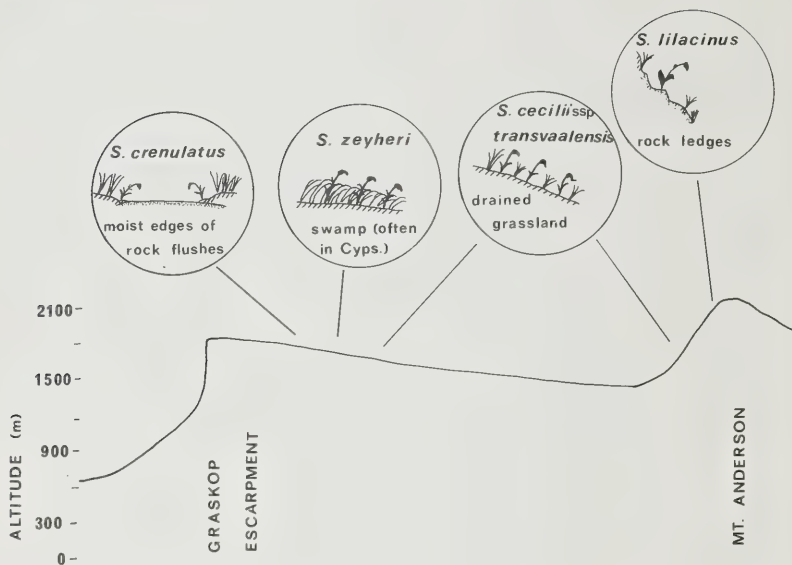


FIG. 3.
Ecological relationships among the species in the Eastern Transvaal escarpment mountains (Pilgrims Rest-Lydenburg area)

The Manica Centre is much poorer and there are not sufficient data to show ecological differentiation among the taxa. Two subcentres—the Inyanga subcentre and the Chimanimani subcentre—may be recognised, each with a single species.

The Southern Riftvalley mountains contain a single species—*S. sulphureus*.

The postulated evolutionary patterns based on morphological relationships are shown in Figure 4. According to this schema convergent evolution occurred in spur length, flower size and distribution of leaves on the scape. The variation in *S. zeyheri* is not indicated on the diagram. The data contained in this schema, combined with ecological and phytogeographical data, have been used to construct Figure 5. This is a hypothetical correlation of all these data to show the possible patterns in speciation in this genus.

DISCUSSION OF MORPHOLOGICAL CHARACTERS

Introduction

Almost all characters show both intra- and interspecific patterns of variation. Extensive variation in a character in one species does not reduce its value as a differential or essential character in another species. Correct species delimitations

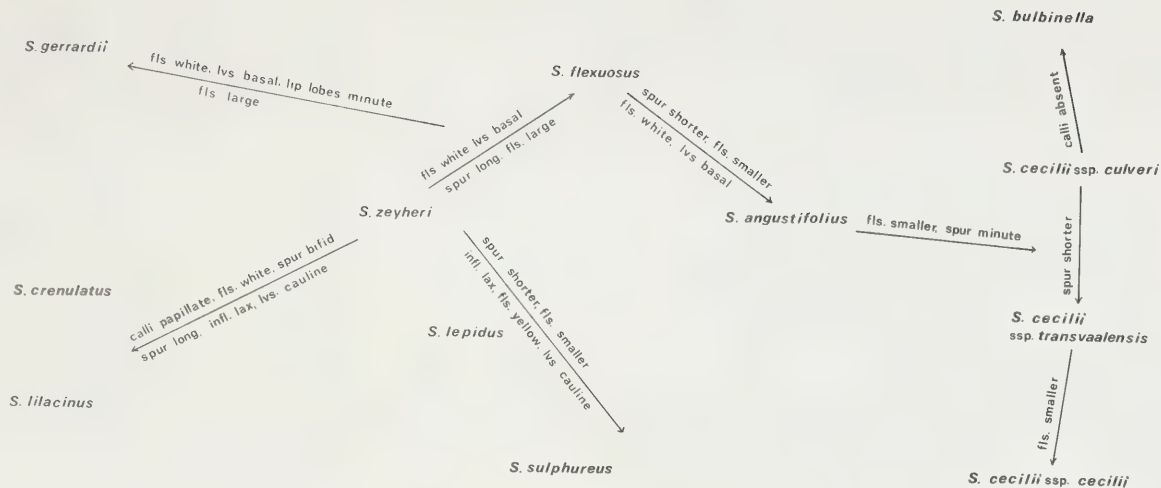


FIG. 4.

Postulated relationships among the taxa based on morphological evidence. The characters above the arrow apply to the species to which the arrow points, those below the arrow are common to the species both sides of the arrow.

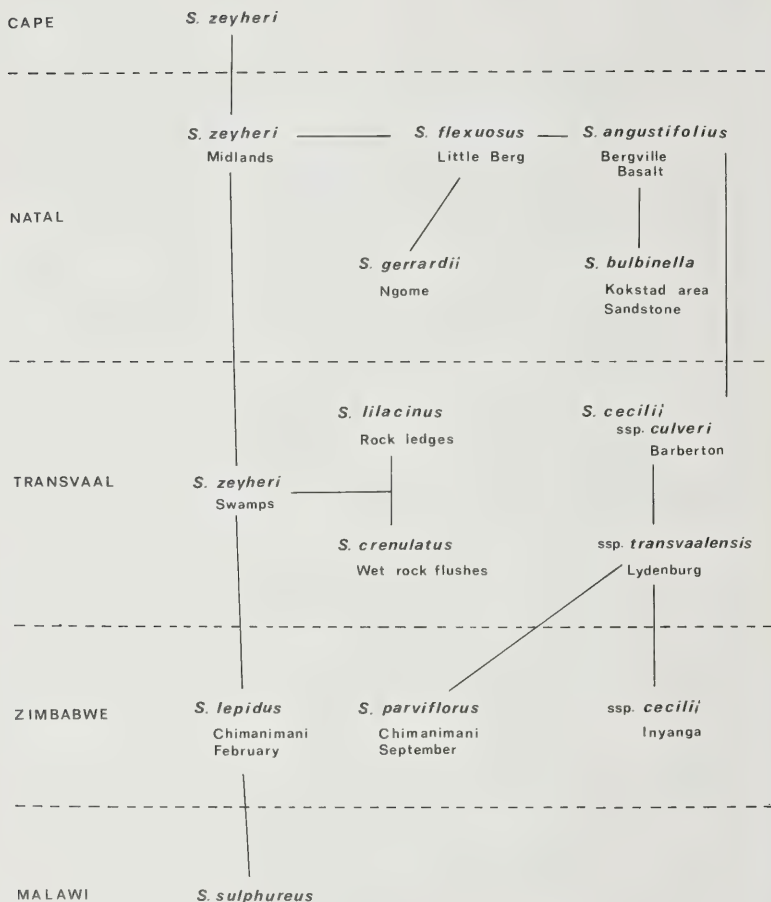


FIG. 5.

Postulated evolutionary relationships based on morphological, ecological and phytogeographical data. Eco-geographical characters separating closely related species are given below the species name.

depend on the careful separation of intra- and interspecific variation. Supra-specific groupings, in turn, depend on an understanding of variation patterns within the genus. Failure to study the variation patterns critically led to the description of numerous species in the past.

Leaf Morphology

- (a) *Leaf shape* ranges from linear to ovate. In taxa such as *S. cecilii* ssp. *transvaalensis*, *S. zeyheri* and *S. bulbinella* variation is immense, but for *S. lilacinus* and others it is excellent as a differential character. This character has been used uncritically in the past.
- (b) *Distribution of leaves*. Although it has taxonomic importance, this character is difficult to quantify. The laminate leaves (as opposed to the sheathing leaves) can either occur in a basal cluster (i.e. *S. flexuosus*, *S. gerrardii*), or be scattered on the lower half of the scape (i.e. *S. zeyheri*, *S. cecilii* ssp. *cecilii*). In depauperate or badly dried specimens, it is frequently difficult to assign a character-state. Although intermediate forms also occur, in the vast majority of the material leaf position is a good character.

Inflorescence Shape

Inflorescence shape is determined by the density and the length of the inflorescence. Density of the inflorescence forms a good character, provided the intermediate state of some taxa is recognised (i.e. *S. lilacinus*). In this work a dense inflorescence is understood as one in which the scape is entirely obscured by floral bracts and flowers. The opposite is a lax inflorescence. The length of the inflorescence determines whether the shape is capitate or oblong. Capitate inflorescences only occur in *S. angustifolius* and *S. flexuosus*, but intermediate states do occasionally occur.

Sepals and Petals

For a genus of 10 species, these floral characters show remarkably little variation. The more peculiar species in the genus do vary: *S. lilacinus* has very narrowly lanceolate sepals and small petals. In the larger-flowered specimens of *S. flexuosus* and *S. zeyheri*, the petal shape changes somewhat—but this appears to be due to the larger flowers. Schlechter (1921) used petal shape to some extent, but without a knowledge of the range of variation displayed by this character.

Spur and Lip

This structure provides a wealth of data that was used extensively in previous attempts at classifying the genus. The lip is a complex structure, for which no satisfactory nomenclature is available. The nomenclature followed in this work is elucidated in Figure 6. In this I am following Summerhayes (1968), but the

terms used do not imply homology to other genera with similarly named structures. Variation occurs in the following structures:

- (a) *Callus*. The presence or absence of a callus and usually the shape of the callus, is consistent within a species. It is a minute structure and difficult to interpret in dried material.
- (b) *Lateral lip lobes*. These can vary from being half the size of the central lip lobe, to being subobsolete. In some taxa the lateral lobes curl up or over the central lobe, making the determination of their real size difficult. The lateral lobes vary from acute to obtuse—but their small size makes an accurate interpretation of their character difficult.
- (c) *Spur*. Can be cylindrical or bifid, tapering or subclavate, straight or somewhat curved. Its size also provides a valuable character, which can usually be determined accurately on dried flowers. Only in *S. zeyheri* does this character show extensive variation.

Flower size and colour

These characters provide excellent data. Although flower size shows extensive intraspecific variation, clear interspecific patterns can be extracted. As it probably influences all other floral characters, it has frequently been used for the major division of the genus. Flower size has several measures. Floral diameter is a measurement across the open flower. For more exact purposes the length of the lateral or the dorsal sepal is used. As these differ in length, it has to be specified which one is used.

Flower colour is particularly valuable. Only three or four colours appear to exist in the genus and only white and yellow occur frequently, either singly or in combination. Only *S. ceciliae* s.l. is polymorphic for colour—in other species colour can be used reliably. The inadequate and difficult to quantify colour terminology, which usually causes problems, is of no consequence here, due to the uncomplicated colour patterns and few basic colours.

TAXONOMY

Schizochilus Sond. in Linnaea 19: 78 (1847); Bentham & Hooker, Gen. Pl. 3: 632 (1883); H. Bol., Icones Orch. Austro-Afr. I t. 18 (1893); Rolfe in Fl. Cap. 5.3: 89 (1912); Schltr. in Beih. Bot. Centralblatt 38: 85 (1921); Phillips, Gen. S. Afr. Fl. Pl.: 186 (1926); Schltr., Die Orchideen ed. 2: 67 (1927); Summerh. in Fl. Trop. E. Afr. 156: 29 (1968); Senghas in Schltr., Die Orchideen ed. 3: 212 (1973); Dyer, Gen. S. Afr. Fl. Pl. 2: 992 (1976).

Type: S. zeyheri Sond.

ETYMOLOGY

The name is derived from the Greek "schizein" = split and "cheilos" = lip. This probably refers to the three-lobed lip.

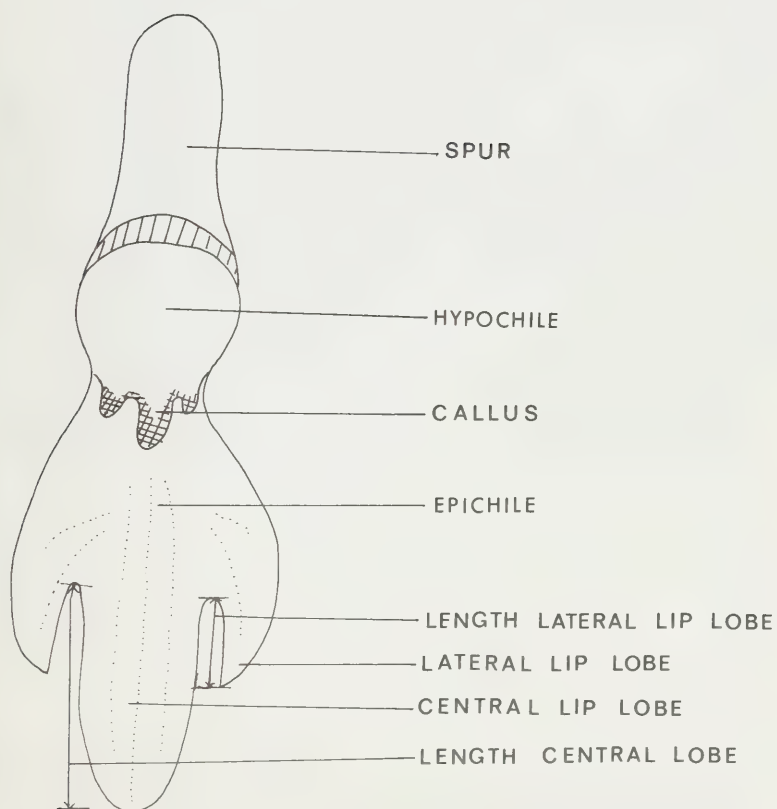


FIG. 6.
Typical lip structure in *Schizochilus*, showing the nomenclature used in this study

ESSENTIAL DIAGNOSIS

Leaves mostly linear, often clustered basally, inflorescence mostly nodding, flowers 1.5–10 mm in diameter, not resupinate; sepals subequal, lateral sepals suboblique; petals usually half as long as sepals; lip three-lobed with the lateral lobes at most half as long as the central lobe; spur 0.2–6 mm long; rostellum three-lobed with the central lobe well developed, glands naked, stigma sessile, flat.

GENERIC DESCRIPTION

Tubers testicular, cylindrico-ovate, 10–50 mm long. *Plants* slender, mostly flexuose, 50–800 mm tall; basal sheaths 1–3, hyaline or white, obtuse or acute, less than 50 mm long; leaves linear to rarely elliptic or narrowly oblanceolate or ovate, 5–30; lower leaves with a free blade 20–150 mm long, acute, semi-erect, usually the midrib prominent below; upper cauline leaves lanceolate to narrowly lanceolate, acuminate, erect, 5–30 mm long, grading into the bracts. *Inflorescence* lax to dense (mostly nodding); ovary 4–15 mm long; bracts usually acuminate, narrowly ovate to narrowly lanceolate, generally as long as the ovary, green; flowers white, white and yellow, yellow, or white with a mauve or pink tint, 1.5–10 mm in diameter. *Sepals* subequal, usually three-nerved; lateral sepals suboblique, lanceolate to ovate, 1.5–14 mm long, more or less acute; dorsal sepal usually somewhat shorter than the laterals, narrowly elliptic to broadly elliptic, or elliptic-oblong to rotund, often apiculate, shallowly galeate. *Petals* $\frac{1}{3}$ – $\frac{2}{3}$ as long

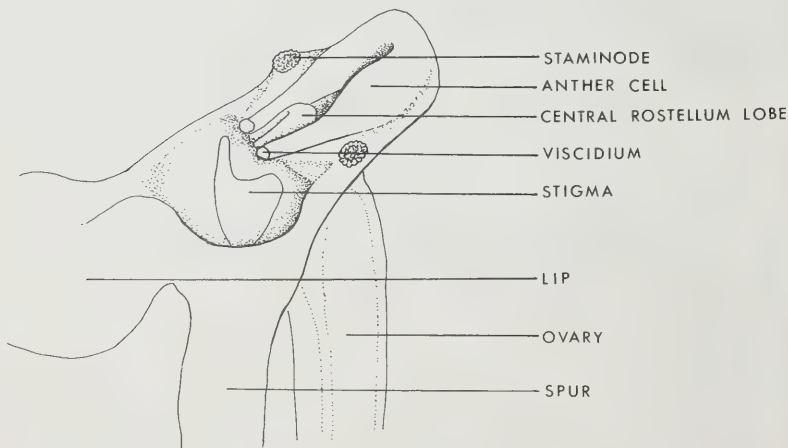


FIG. 7.

Gynostemium of *S. flexuosus* Rolfe, showing the typical structure of the rostellum

as the sepals, single-veined, oblique, usually more or less rhomboid and acute. *Lip* about as long as the sepals; the epichile more or less three-lobed, the central lobe longer than the lateral lobes; hypochile concave, leading into the spur, frequently with calli between the hypochile and the epichile; spur cylindrical to bifid, slender to clavate, always shorter than the lip, generally straight. *Rostellum* three-lobed, the central lobe a fold between the anther cells, the lateral lobes square, carrying naked viscidia. *Anther* erect or angled to 45°, 0.5–1.5 mm long. *Stigma* flat, single, borne on the column below the rostellum, above the entrance to the spur.

KEY TO THE SPECIES

- 1 Sepal 4 mm long or longer; spur 2–6 mm long in South Africa, 0.8–2 mm long north of Limpopo
 - 2 Inflorescence lax; leaves cauline
 - 3 Flowers bright yellow; spur rarely clavate; widespread
 - 4 Spur longer than 2.2 mm; from South Africa. 6. *S. zeyheri*
 - 4' Spur shorter than 2.2 mm; from north of Limpopo
 - 5 Spur 0.8–1.2 mm long; from Malawi. 8. *S. sulphureus*
 - 5' Spur 1.2–2.2 mm long; from the Chimanimani mountains. 7. *S. lepidus*
 - 3' Flowers white or white with mauve veins; spur clavate; from the Eastern Transvaal
 - 6 Sepals 5–7 mm long; leaves narrowly lanceolate to linear, more than 4. 9. *S. crenulatus*
 - 6' Sepals 8–14 mm long; leaves elliptical, 3–5. 10. *S. lilacinus*
 - 2' Inflorescence dense, capitate; leaves in a basal cluster
 - 7 Flowers white or pinkish; lateral lip lobes subobsolete; from Ngome (Zululand). 3. *S. gerrardii*
 - 7' Flowers white with a yellow lip or completely yellow; lateral lip lobes $\pm \frac{1}{2}$ as long as the central lobe
 - 8 Spur shorter than 2 mm; plants from the Drakensberg at Bergville or Harrismith, above 2 200 m. 4. *S. angustifolius*
 - 8' Spur longer than 2.5 mm, not above localities
 - 9 Flowers white with a yellow lip; from Drakensberg foothills in Natal and East Griqualand. 5. *S. flexuosus*
 - 9' Flowers bright yellow; from Eastern Cape, as far N.E. as Maclear, rarely elsewhere. 6. *S. zeyheri*
- 1 Sepals 4 mm long or shorter; spur 1.2–0.2 mm long in South Africa, 0.5–2 mm long in Zimbabwe
 - 10 Spur shorter than 0.6 mm
 - 11 Leaves in a basal cluster of more than 5; from the southern Drakensberg; lip without calli. 2. *S. bulbinnella*
 - 11' Leaves cauline or not more than 3 basal, from Eastern Transvaal or Zimbabwe; lip with 3 calli
 - 12 Dorsal sepal less than 3 mm long; from Inyanga, Zimbabwe, flowers white or yellow. 1a. *S. ceciliae* ssp. *ceciliae*
 - 12' Dorsal sepal more than 3 mm long, from South Africa, flowers white. 1b. *S. ceciliae* ssp. *transvaalensis*
 - 10' Spur longer than 0.6 mm
 - 13 Sepals less than 3.5 mm long; yellow; from Barberton and Swaziland. 1c. *S. ceciliae* ssp. *culveri*
 - 13' Sepals more than 3.5 mm long; white; from Harrismith and Bergville. 4. *S. angustifolius*

1. *Schizochilus cecilii* Rolfe in Kew Bull. 1906: 168 (1906)

Plants subflexuose, slender, 100–300 mm tall; tubers testicular, up to 30 mm long and 10 mm in diameter; basal sheath(s) hyaline or white, 10–30 mm long, obtuse to acute; leaves 6–15; the lower 3–6 leaves clustered in the basal $\frac{1}{5}$ th of the scape or basal, linear to narrowly oblanceolate, acute, semi-erect, up to 100 mm long; the remaining leaves scattered up the scape, lanceolate, acute to subacuminate, smaller towards the apex and finally grading into the floral bracts, 5–30 mm long. *Inflorescence* dense, up to 70 mm long and 10 mm in diameter, about 40-flowered; ovary ca. 4 mm long; bracts as long as or longer than the ovary, narrowly ovate to ovate, subacuminate; flowers small, ca. 2–3 mm in diameter, bright yellow or white. *Sepals* subequal, 1 or 3 veined; concave; dorsal sepal elliptic to rotund, obtuse, 2–4 mm long; lateral sepals subobliquely lanceolate to ovate, subacute, 2.5–4 mm long. *Petals* single-veined, rhomboid-rotund to ovate, acute, shallowly concave, curved over the anther, 1.3–3 mm long. *Lip* 3–3.6 mm long, 1.5–1.8 mm wide; epichile trilobed, central lobe ca. 1 mm long, lateral lobes less than half as long as the central lobe, lobes subacute; hypochile deeply concave, somewhat smaller than the epichile; disc between hypochile and epichile with three fleshy calluses; spur cylindrical, straight, 0.2–1 mm long. *Anther* curved, ca. 1 mm long.

DIFFERENTIAL DIAGNOSIS

This polytypic species belongs to the small-flowered group in *Schizochilus*, characterised by the sepals shorter than 4 mm and the spur shorter than 1 mm. In this group it can be distinguished from *S. bulbinella* by the presence of calli on the lip.

BIOLOGY

This species extends from Swaziland northwards along the escarpment mountains to Inyanga in Zimbabwe. Along this range it occurs in the Swaziland–Barberton mountain complex (spp. *culveri*), in the Pilgrims Rest–Lydenburg area (ssp. *transvaalensis*) and in Inyanga (ssp. *cecilii*). Over the whole range it occurs in sour secondary grassland (Acocks, 1975; Rattray, 1961). Rainfall ranges from 1 000 to 1 900 mm p.a., mostly in the summer (W.B. 29; Jackson, 1961). Mists and cloud occur frequently; snow does not occur. In this habitat it occurs in damp to well-drained grasslands, generally associated with rocky outcrops or shallow soil.

Flowering occurs from December to January and a scent has occasionally been detected. The pollination biology is unknown.

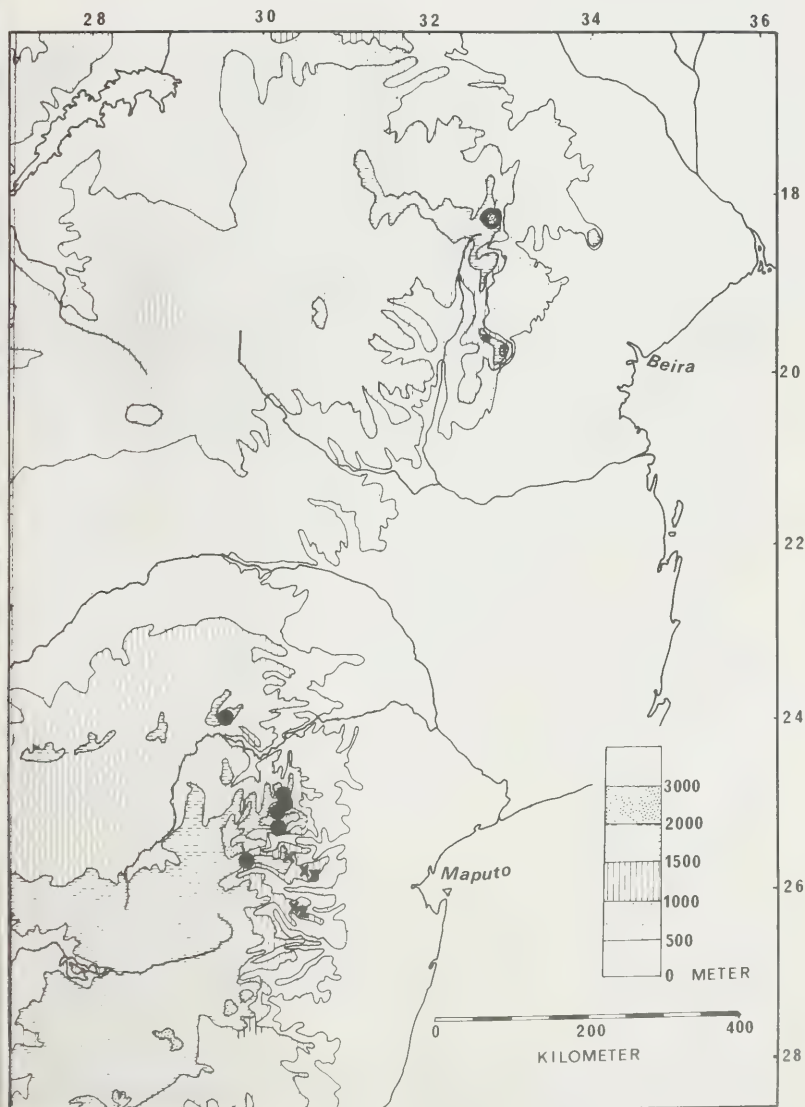


FIG. 8.

Distribution of *S. cecilia* s.l.: ○ *S. cecilia* spp. *cecilia*; ● *S. cecilia* ssp. *transvaalensis*; × *S. cecilia* ssp. *culveri*.

VARIATION

Although the three subspecies present a somewhat differing aspect, a critical analysis of the variation leaves almost no differentiating characters.

- (a) Vegetative characters: *S. cecilii* ssp. *cecilii* is fairly uniform in its vegetative characters, the leaves being narrowly oblanceolate to very narrowly elliptical and somewhat rigid. In ssp. *culveri* the leaves are more linear and vary from being almost basal, to scattered on the scape. In ssp. *transvaalensis* field studies have revealed an enormous range, apparently dependent on habitat conditions. In the wetter and more densely vegetated areas, plants generally had 2–3 large leaves (Linder 1997), whereas on drier drained slopes over bedrock, numerous linear leaves were produced (Linder 2002). On Graskop Peak a complete range of intermediates occurred, dependent on the aspect of the slope (Linder 1999) (Fig. 9).
- (b) Flower colour: Two states of this character occur: flowers are either yellow or white. Occasionally the white tends to cream, often the lip of the flower is cream. *S. cecilii* ssp. *culveri* always has yellow flowers. Galpin 1144, according to the collector's notes, had white flowers, but the flowers dried an off-white colour, indicating that they might well have been yellow. In ssp. *transvaalensis* only white or (rarely) cream flowers have been recorded, except for Marais 318, annotated as "bright yellow". However, in ssp. *cecilii* both colours appear. Yellow-flowered forms have been collected more frequently. Wild 4939 notes both yellow and white flowers in the same colony. Carley 360, Fisher 4151 and Whellan 604 note both yellow and white flowers, with white usually rare. Norlindh & Weimarck 4822 and 4973, and Beasley 37 note cream flowers.
- (c) Flower size: An analysis of all available material shows that the Zimbabwean material is consistently smaller flowered than the Lydenburg material. Collections from Barberton and Swaziland are intermediate.
- (d) Spur length: Material from Zimbabwe and Sabie-Lydenburg group together, with spurs less than 0.6 mm long, whereas the Barberton-Swaziland material has a spur 0.8–1 mm long.

There is thus a certain amount of variation, some of which fits the geographical patterns. As the forms occupy the same habitat over the whole range, but show some degree of morphological differentiation, they can be understood to be semi-species (Grant, 1971; White, 1978b). Formally, they are best recognised as subspecies.

a. ***Schizochilus cecilii* Rolfe ssp. *cecilii***

Schizochilus cecilii Rolfe in Kew Bull. 1906: 168(1906): Type: Rhodesia, Inyanga Mountains, 1 800–2 100 m, Cecil 202 (K! holotype); Schltr. in Beih. Bot. Centralblatt 38: 93 (1921).

DIAGNOSIS

Flowers white or yellow; dorsal sepals 2–2,7 mm long, lateral sepals 2,7–3,7 mm long; spur 0,1–0,5 mm long, from Inyanga (Zimbabwe).

REPRESENTATIVE MATERIAL

Inyanga Fort, moist soil, flowers yellow, very abundant, 31.I.1948, *Fisher 1451* in SRGH 22287 (SRGH!, NU!, K!); summit of Mt. Inyangani in rock, flowers cream, 14.II.1931, *Norlindh & Weimarck 4973* (K!).

- b. ***Schizochilus cecilii* Rolfe ssp. *transvaalensis*** (Rolfe) Linder, comb. nov. et stat. nov.: Basionym: *Schizochilus transvaalensis* Rolfe in Fl. Cap. 5.3: 92 (1912): Type: near Lydenburg, *Atherstone*; *Mac-Mac*, *Mudd* (? syntype; BOL!); Graskop, *Burt Davy 1464* (? syntype; BOL!); Schltr. In Beih. Bot. Centralblatt 38: 93 (1921)

? *Schizochilus tenellus* Schltr. in Beih. Bot. Centralblatt 38: 92 (1921): Type: near Lydenburg, December 1893, *Schlechter 3934a* (B†, holotype).

DIAGNOSIS

Flowers white or cream, very rarely yellow; dorsal sepal 2,8–3,8 mm long, lateral sepals 3,5–4,5 mm long; spur 0,2–0,6 mm long; from the Pilgrims Rest and Lydenburg areas.

NOMENCLATURAL NOTES

When Rolfe (1912) described *S. transvaalensis*, he did not indicate how he separated it from *S. cecilii*, which he had described six years before. Schlechter (1921) confessed that he had not seen any material of *S. cecilii* or *S. transvaalensis*, and based his decisions on Rolfe's descriptions. He noted that *S. cecilii* and *S. transvaalensis* appear to be very similar, but that *S. transvaalensis* has larger flowers. He also noted the affinity between these two taxa and *S. culveri*. He did not note the affinity between these taxa and *S. tenellus*, which he placed near *S. gerrardii*. I have not seen the type of *S. tenellus* but from the description it is likely to be the same as *S. cecilii* ssp. *transvaalensis*.

REPRESENTATIVE MATERIAL

Pilgrims Rest near Graskop at Gods Window, flowers white, in damp grassland, 4.I.1979, *Linder 1997* (BOL!, PRE!, K!); Lydenburg, near summit of Long Tom Pass, flowers white, in shallow soil; 5.I.1979, *Linder 2002* (BOL!, PRE!, K!)

- c. ***Schizochilus cecilii* Rolfe ssp. *culveri*** (Schltr.) Linder, comb. nov. et stat. nov.: Basionym: *Schizochilus culveri* Schltr. in Beih. Bot. Centralblatt 38: 90 (1921): Type: Barberton, Little Lomati Valley, *Culver 76* (B†, holotype; BOL!).

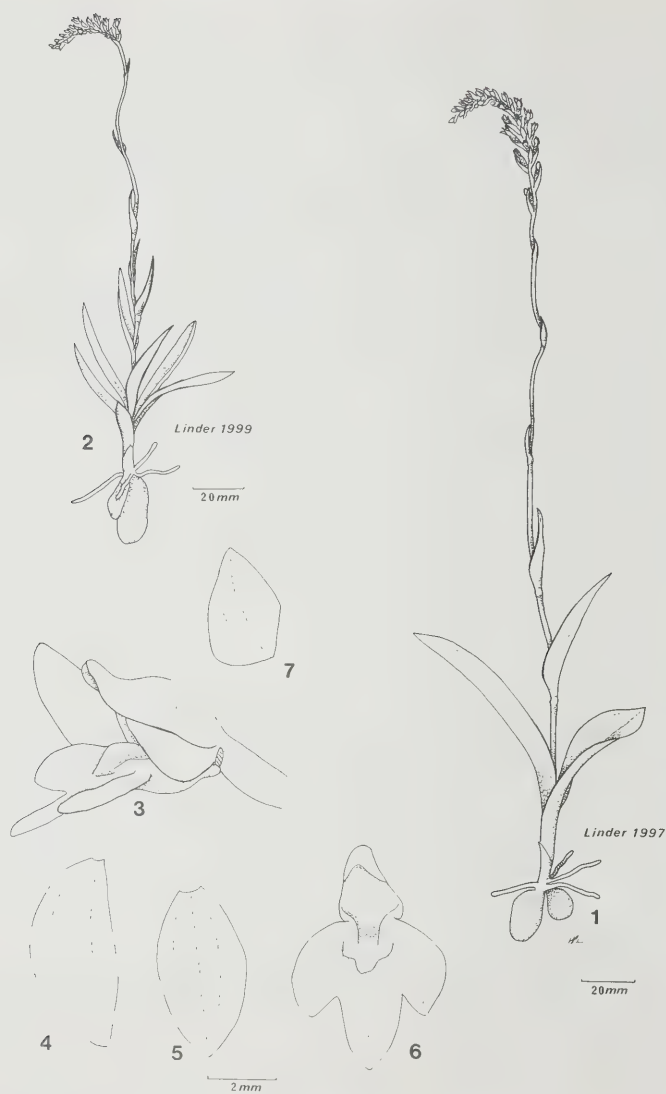


FIG. 9.

S. cecilia ssp. *transvaalensis*. 1. *Linder 1997* from damp conditions near Gods Window, whole plant. 2. *Linder 1999* from dry conditions on Graskop Peak, whole plant. 3 to 7 based on *Linder 1999*: 3. Side view of flower with the lateral sepal removed. 4. Lateral sepal. 5. Dorsal sepal. 6. Lip. 7. Petal.

Schizochilus galpinii Schltr. in Beih. Bot. Centralblatt **38**: 92 (1921): Type: Swaziland, mountaintops at Horo Concession, December 1890, *Galpin 1144* (B†, holotype; BOL!, PRE!).

Schizochilus bulbinella auct. non (Reichb.f.) H.Bol.: Rolfe (1912) pro parte; Compton, Fl. Swaziland: 156 (1976).

DIAGNOSIS

Flowers yellow; sepals 2.5–3.5 mm long, spur 0.8–1 mm long; in mountains between Barberton and Mbabane.

NOMENCLATURAL NOTES

Rolfe included *Galpin 713* in *S. bulbinella*—Schlechter noted that this collection could be separated on the basis of the lip shape, and the presence of lip calli, and described it as *S. culveri*. In the same publication he described *S. galpinii*, which differs mainly in having white flowers. Analysis of isotype material has revealed no other differences from the type of *S. culveri*. The concept of *S. culveri* was still not clear, and in 1976 Compton mistook material of *S. culveri* for *S. bulbinella*.

REPRESENTATIVE MATERIAL

Barberton, Bosch's, flowers bright golden yellow, XI.1889, *Galpin 713* (BOL!, GRA!); Mbabane, Nduma, in rock crevices, flower bright yellow, 19.I.1956, *Compton 25382* (PRE!).

2. ***Schizochilus bulbinella*** (Reichb.f.) H.Bol. in Jl. Linn. Soc. **25**: 205 (1889); Dur. & Schinz, Consp. Fl. Afr. **5**: 116 (1894); Rolfe in Fl. Cap. **5.3**: 93 (1912); Schltr. in Beih. Bot. Centralblatt **38**: 89 (1921); Jacot Guillarmod, Fl. Lesotho: 157 (1971); Ross, Fl. Natal: 142 (1972).

Brachycorythis bulbinella Reichb.f. in Flora **1867**: 116 (1867): Type: Faku District, *Dr Sutherland* (? holotype).

Platanthera bulbinella (Reichb.f.) Schltr. in Bot. Jahrb. 20 Beih. **50**: 12 (1895).

Gymnadenia bulbinella (Reichb.f.) Kraenzl. in Orch. Gen Sp. **1**: 561 (1898).

Schizochilus burchellii Jackson in Ind. Kew. Suppl. **1**: 384 (1906) (nom. nud.).

Plants slender, subflexuose, 80–250 mm tall; tubers testicular, 20–40 mm long, ca. 10 mm in diameter; basal sheaths several, obtuse to acute, hyaline to white, 20–40 mm long; leaves 10–30, the lower 4–20 basal, semi-erect, 30–50–100 mm long, usually all the same length, 2–5–9–(14) mm wide, acute, somewhat conduplicate, very narrowly oblanceolate with the midrib prominent below, the upper 5–10 leaves scattered on the scape, acute to subacuminate, 5–20 mm

long, 2–4 mm wide, grading into the floral bracts. *Inflorescence* dense, generally oblong cylindrical, 20–40 mm long, ca. 10 mm in diameter; ovary 3–4 mm long; bracts as long as or somewhat longer than the ovary, narrowly ovate, acuminate; flowers small, ca. 3 mm in diameter, bright yellow. *Sepals* subequal, three-nerved; dorsal sepal very broadly obovate to rotund, apiculate, deeply galeate, 2.5–3 mm long; lateral sepals obliquely narrowly ovate, subacute, shallowly keeled, 2.5–3.5 mm long. *Petals* single-veined, suboblique, broadly ovate, obtuse, shallowly concave and curved over the anther, 1.5–2 mm long. *Lip* 3–4 mm long, 1–2 mm wide; epichile trilobed, central lobe ca. 1 mm long, lateral lobes ca. 0.3 mm long or smaller, curved over the central lobe; hypochile much smaller than the epichile, deeply concave, no calli present; spur cylindrical, obtuse, ca. 0.3 mm long. *Anther* erect, ca. 0.8 mm long.

DIFFERENTIAL DIAGNOSIS

The small (sepals 2.5–3.5 mm long) flowers place this species in the small-flowered group. It is unique in this group by the absence of calli, dense cluster of basal leaves and relatively small lateral lip lobes and the narrow lip. It is geographically isolated in the southern Drakensberg from the other small-flowered taxa.

VARIATION

This species shows little variation, except in the width and number of basal leaves. These two characters have been found to vary within one population.

BIOLOGY

S. bulbinella is restricted to the Drakensberg and its outliers between Underberg and Maclear. The altitudinal range is from 1 500 m to 2 500 m above sea-level. Acocks (1975) described this veld type as "Highland Sourveld". Killick (1963) placed it in the "Subalpine Belt". Both grassland and proteoid savanna occur in this vegetation type. Precipitation ranges from 750–1 200 mm p.a., mostly in summer, with snow-falls in the winter (W.B. 29).

All the populations studied were in shallow (10–100 mm) soil over rock, usually in slightly damp to dry situations, never in wet places. Most of the populations were on Cave Sandstone, but the species has been recorded from Basalt and Dolerite. The habitat comparative to the other species of *Schizochilus* in Natal is indicated in Figure 2.

Populations tend to be large, with 50–200 plants, frequently growing sociably. Within its distribution range this species is by no means rare.

Hilliard and Burtt 8927 indicate a scent, but this is the only record; the author could not detect one. Although copious seed-set has been observed, the pollination biology is unknown. Flowering occurs during January and February.

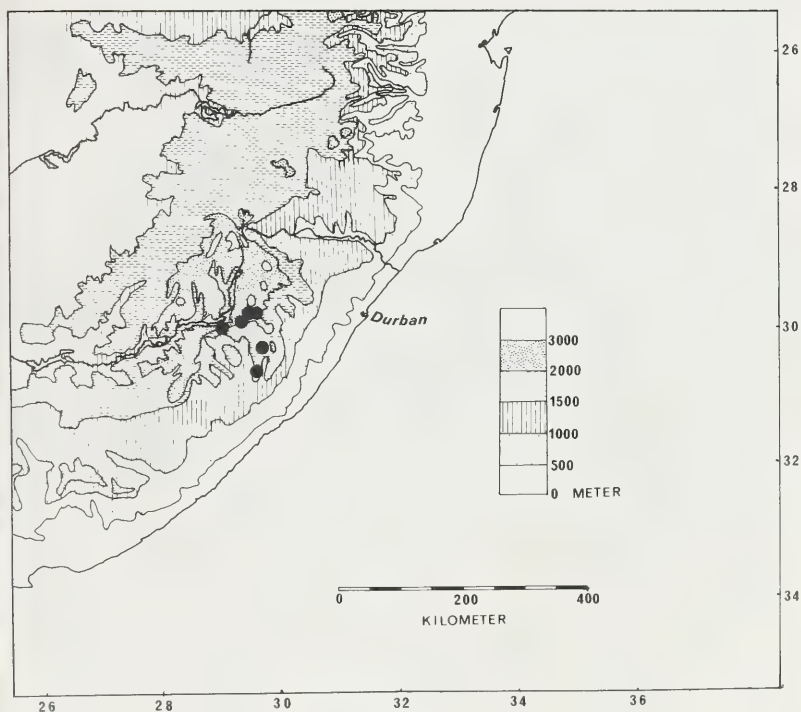


FIG. 10.
Distribution of *S. bulbinella* (Reichb. f.) H. Bol.

NOMENCLATURAL NOTES

The type collection is from Fakus District, in East Griqualand. The only synonym is the *nomen nudum* described—probably by accident—in *Index Kewensis*.

REPRESENTATIVE COLLECTIONS

Mt. Curry, 1 950 m. II.1883, *Tyson 1072* (BOL!, GRA!); Ramatseliso, stony plateau, flowers yellow, common, 30.I.1977, *Boardman 239* (PRE!); Underberg. Bushmansnek, 2 400 m, flowers deep yellow, fragrant, on stony places, 4.II.1976, *Hilliard & Burt 8927* (NU!).

3. *Schizochilus gerrardii* (Reichb.f.) H.Bol. in Jl. Linn. Soc. **25**: 205 (1889); Dur. & Schinz, *Consp. Fl. Afr.* **5**: 116 (18923; Rolfe in *Fl. Cap.* **5.3**: 94 (1912); Schltr. in *Beih. Bot. Centralblatt* **38**: 91 (1921).

Brachycorythis gerrardii Reichb.f. in *Flora* **1867**: 116 (1867); Type: Ingoma, *Gerrard 1542* (TCD!, holotype).

Platanthera gerrardii (Reichb.f.) Schltr. in *Bot. Jahrb.* **20** Beih. **50**: 12 (1895).

Gymnadenia gerrardii (Reichb.f.) Kraenzl. in *Orch. Gen. Sp.* **1**: 562 (1898).

Plant slender, often subflexuose, 150–300 mm tall; tubers testicular, up to 40 mm long and 20 mm in diameter; outer basal sheath hyaline with brown veins, obtuse, ca. 20 mm long; inner sheath white, acute to apiculate; leaves up to 25; the lower 6–10 leaves basal, linear, acute to subacuminate, semi-erect, up to 110 mm long and 10 mm wide, usually 70 mm long and 5 mm wide; the remaining leaves more or less narrowly ovate, erect, sheathing, scattered up the scape, basally up to 60 mm long, apically grading into the floral bract. *Inflorescence* dense, cylindrical, up to 50 mm long and ca. 15 mm in diameter, ca. 50 flowered; ovary ca. 5 mm long; bracts longer towards the base of the spike, overtopping the flowers, narrowly ovate, acuminate; flowers 5–8 mm in diameter, white suffused with pink or mauve, veins on sepals mauve, lip with a greenish spot on the disc. *Sepals* three-nerved, subequal; dorsal sepal narrowly elliptic to elliptic, concave, acute to apiculate, 5–7.5 mm long; lateral sepals suboblique, lanceolate to narrowly ovate, shallowly keeled, acute, 5–8 mm long. *Petals* one-nerved, obliquely rhomboid-ovate, acute, 2.5–3 mm long. *Lip* 4–6 mm long, 2 mm wide, epichile obscurely tri-lobed, lobes acute, central lobe ca. 1 mm long, lateral lobes 0.1–0.2 mm long; lateral lobes upcurved; hypochile concave, smaller than the epichile; disc between hypochile and epichile with three calli; spur cylindrical, obtuse, straight, ca. 1 mm long. *Anther* erect, ca. 1 mm tall.

DIFFERENTIAL DIAGNOSIS

This species belongs in the large-flowered group, with sepals longer than 4 mm. In this group, the almost obsolete lateral lip lobes and the green disc are unique. The basally clustered leaves separate it from most of the *S. zeyheri* group. It is the only species of *Schizochilus* occurring on the Ngome Highlands in Zululand.

VARIATION

Although this species occupies such a small area, extensive inter-population variation in flower colour, flower size and tepal shape occurs. Populations at the extremes of the distribution range (Linder 1953, 1960) have smaller flowers with wider sepals, than populations near the centre of the range (i.e. Linder 1957). Flower colour showed a gradient from almost pure white flowers (Linder 1953, at

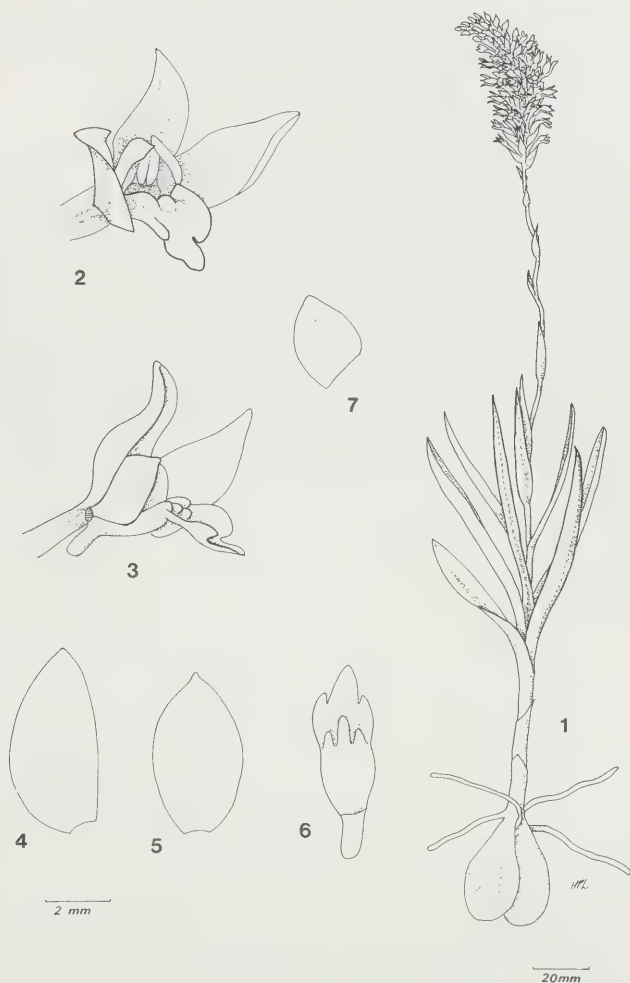


FIG. 11.

S. gerrardii (Reichb. f.) H. Bol., from Linder 1960. 1. Whole plant. 2. Flower, front view. 3. Flower with lateral sepal removed, side view. 4. Lateral sepal. 5. Dorsal sepal. 6. Lip. 7. Petal.

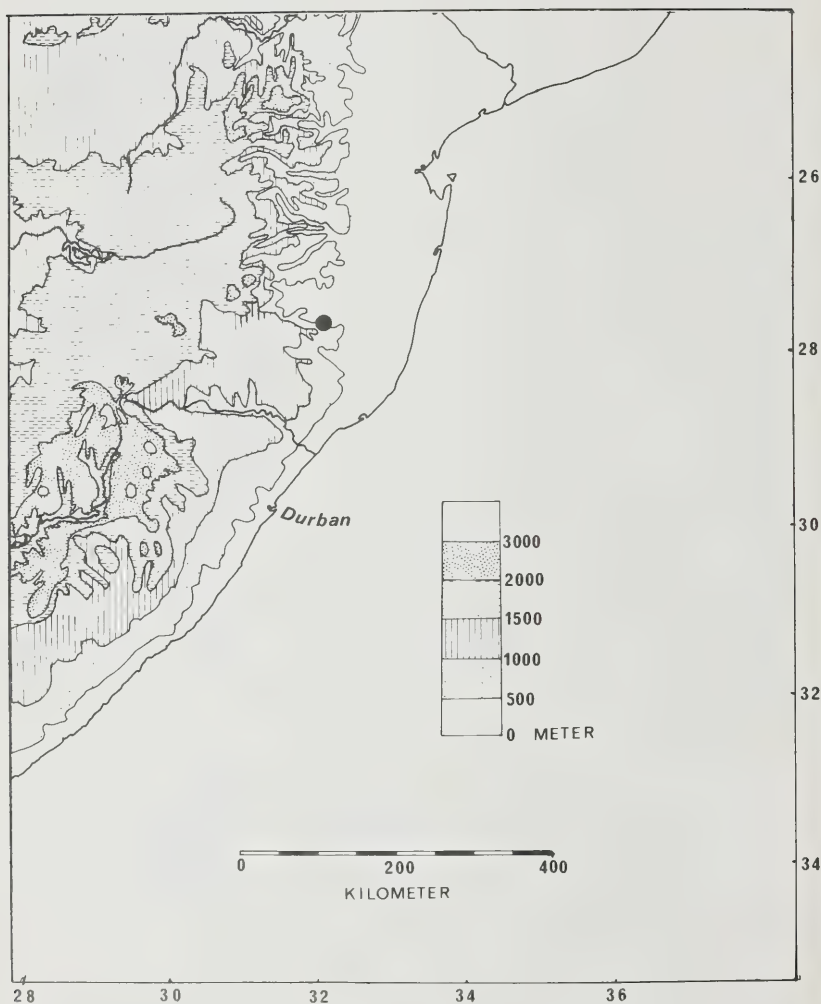


FIG. 12.
Distribution of *S. gerrardii* (Reichb. f.) H. Bol.

the eastern end of the range) through flowers somewhat suffused with pink, with darker pink veins, in the centre of the range (Linder 1957) to flowers all deeply suffused with pink at the western end of the range (Linder 1960).

BIOLOGY

Schizochilus gerrardii appears to be restricted to the Ngome and Ceza Highlands (3127 CD) on the spur between the Mkuze and Black Umfolozi Rivers, at an altitude of ca. 1 200 m. Acocks (1975) mapped the area as Veld type 8: North-eastern Mountain Sourveld, a very sour secondary grassland dominated by *Themeda triandra*. Bayer (1938) mentions the existence of a "grassland formation" in this area. The rainfall in the area is about 1 600 mm (W.B. 29), of which 82 % falls in summer.

S. gerrardii occurs around the margins of outcropping bedrock in shallow soil. Frequently there are slight seepages. Only rarely do isolated plants occur in grassland. It is a sociable species, and usually locally abundant. Plants often form dense clusters. Although this species is thus relatively common in its habitat, the extension of the *Pinus patula* plantations could drastically reduce the total number of existing populations.

There is no record of any scent, and nothing is known about the pollination biology of this species. Copious seed-set was observed. Flowering occurs from December to February.

NOMENCLATURAL NOTES

Until recently, this species was only known from the type collection. Rolfe extended the species concept to include material from *S. cecilii* ssp. *transvaalensis* (Wilms 1385) and from *S. flexuosus* Rolfe (*Schlechter 6477*, Krook in Herb. Penther 660). Schlechter understood the species as defined here. Ross (1972) however, followed Rolfe (1912), and cited *Schlechter 6477* as material of *S. gerrardii*, and he gives the distribution range of *S. gerrardii*, as understood by him, as Natal Uplands. However, this species is restricted to Zululand. The treatment of Ross thus has to be understood as a misidentification.

REPRESENTATIVE MATERIAL

Zululand, Natal, Ngome, 1.I.1979, Linder 1957 (BOL, PRE, NU, K); Zululand, Ngome, near sawmill, 7.XII.1975, Hilliard & Burt 8418 (NU).

4. *Schizochilus angustifolius* Rolfe in Fl. Cap. 5.3: 93 (1912): Type: Van Reenen, 1 500–1 800 m, Wood 3444 (K, lectotype; BOL!); Ross, Fl. Natal: 142 (1972).

Schizochilus albiflos Schltr. in Beih. Bot. Centralblatt 38: 91 (1921) : Type: Mount Aux Sources, Wood s.n. (B†, holotype; SAM!, NBG!, GRA!).

Plants slender, subflexuose, 50–200 mm tall; tubers testicular, ca. 15 mm long, 10 mm in diameter; basal sheath hyaline acute; leaves 7–14; about $\frac{2}{3}$ of the leaves in a basal cluster, linear to narrowly oblanceolate, semi-erect, shallowly keeled, acute, 30 to 60 mm long; the remainder scattered on the scape, grading from the basal leaves into the floral bracts, more or less acuminate. *Inflorescence* dense, cylindrical-oblong, up to 40 mm long and 10 mm in diameter; ovary ca. 4 mm long; bracts as long as the ovary, narrowly ovate, acuminate; flowers 2–3 mm in diameter, sepals and petals white, lip yellow. *Sepals* subequal, tri-nerved; 4–5 mm long; dorsal sepal broadly elliptic, galeate, apiculate; lateral sepals suboblique, narrowly ovate to ovate, shallowly keeled, obtuse to acute. *Petals* single-nerved, ovate, acute, ca. 2 mm long. *Lip* 3,5–5 mm long, epichile broadly three-lobed, central lobe ca. 1,5 mm long, lateral lobes 0,8 mm long, all acute; hypochile much smaller than the epichile, concave, no calli present; ca. 3 mm wide; spur obtuse, ca. 1 mm long. *Anther* erect, ca. 1 mm tall.

DIFFERENTIAL DIAGNOSIS

S. angustifolius is intermediate between the small-flowered and large-flowered groups. The yellow and white flowers and the sepal length of 4–5 mm, distinguish it from the small-flowered group. From the South African representatives of the large-flowered group it can be separated by the short spur (1 mm long), and from *S. gerrardii* by the smaller flowers. It is the only species of *Schizochilus* occurring in basalt in the Northern Natal Drakensberg.

BIOLOGY

This species appears to be restricted to altitudes between 2 100 m and 3 000 m in the Drakensberg between Giant's Castle and Harrismith Platberg. Acocks (1975) termed the vegetation in this zone as Veld type 58: *Themeda-Festuca* Alpine veld. He describes it as a short dense grassland on black turfy soils. West (1951) and Herbst and Roberts (1974) term the vegetation as alpine, whereas Killick (1963, 1978) defines it as sub-alpine. Herbst and Roberts (1974) indicate a rainfall of ca. 1 270 mm, and a temperature range of 22 °C to –13 °C. Snow occurs frequently in winter, and the rainfall is almost entirely in summer.

The habitat is usually described as being "between stones", but I have found this species growing in grassland, on steep bare banks above old footpaths, in slightly damp localities. The single population studied was fairly extensive, but the plants showed little sociability. No estimates of the number of populations is possible—the area has not been extensively investigated.

No scent has been recorded, and although copious seed-set was observed, the pollination biology of this species is unknown. Flowering occurs in January and February.

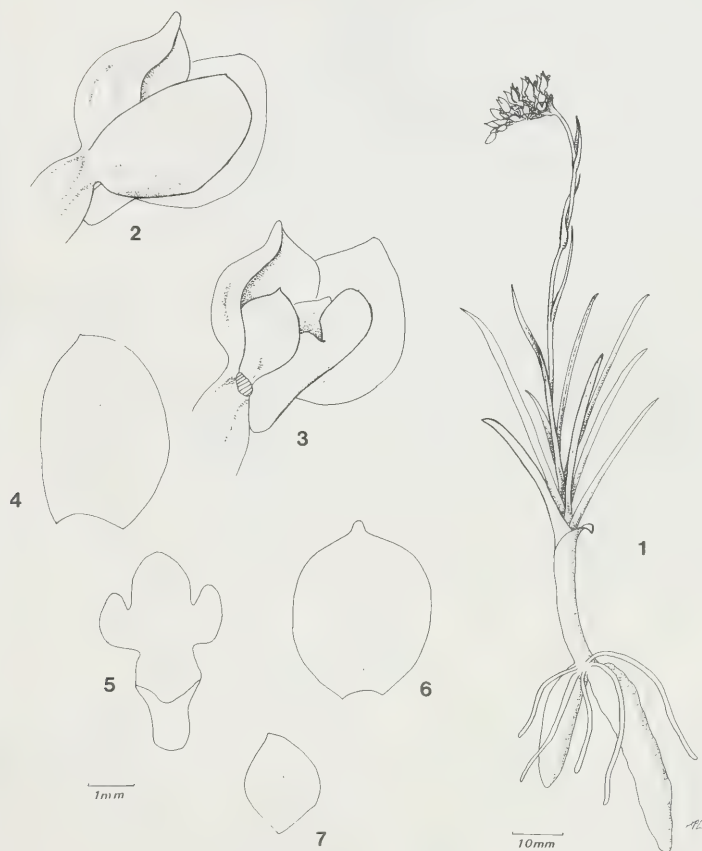


FIG. 13.

S. angustifolius Rolfe. 1. Whole plant, from Jacobsz 2523. 2 to 7 from Linder 2077.
 2. Side view of flower. 3. Side view of flower with lateral sepal removed. 4. Lateral sepal.
 5. Lip. 6. Dorsal sepal. 7. Petal.

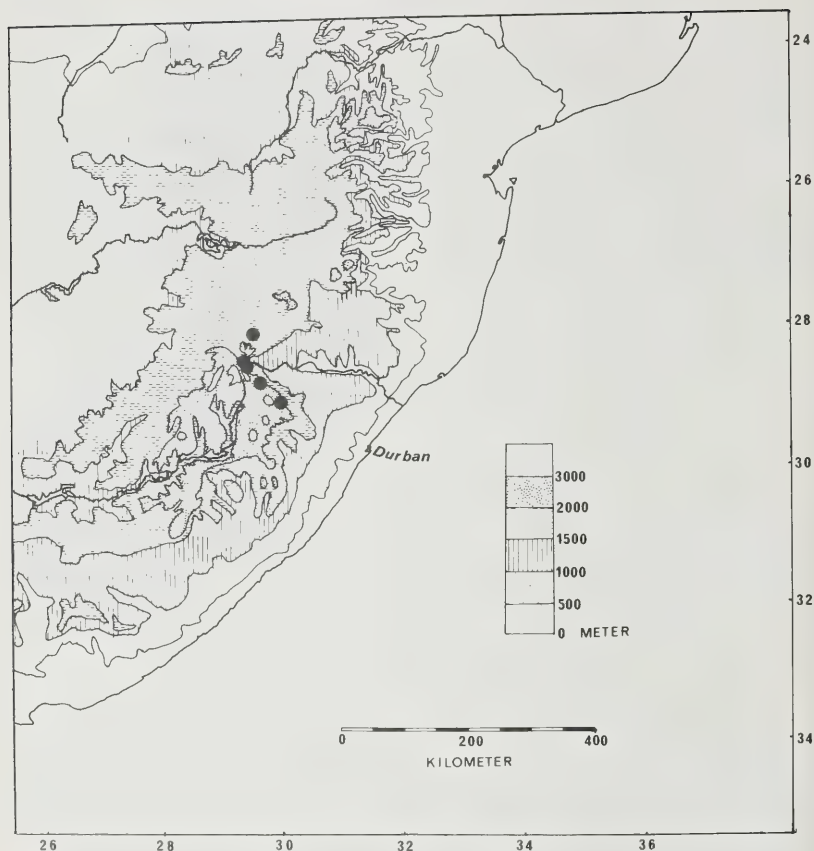


FIG. 14.
Distribution of *S. angustifolius* Rolfe

NOMENCLATURAL NOTES

Rolfe based his species on *Sankey 256*, *Wood 3444*, *Allison 6* and *Schlechter 6484*. Of these, the first three collections agree with the concept of this species as understood here; *Schlechter 6484* has to be included in *S. flexuosus* Rolfe. In 1921 Schlechter, pointing out that *S. angustifolius* was based on a mixed type, lectotypified *Schlechter 6484*—as a reason he stated that the description fits this collection best. For the remaining collections he proposed the name *S. albiflos*,

with *Wood s.n.* (Van Reenen) as type. A careful comparison of both *Schlechter 6484* and *Wood 3444* with Rolfe's description shows that the description agrees more with *Wood 3444* than with *Schlechter 6484* (See Table 1). Rolfe's key determines *Wood 3444* as *S. angustifolius* and *Schlechter 6484* as *S. flexuosus*. According to Article 8 of the I.C.B.N. (1978): "The author who first designates a lectotype or a neotype must be followed, . . . it may be superseded if it can be shown that the choice was based upon a misinterpretation of the protologue . . .". In this case, as the protologue does not agree with *Schlechter 6484*, *Wood 3444* is proposed as the lectotype of *S. angustifolius* Rolfe, and *S. albiflos* sensu Schltr. is reduced to the synonymy of *S. flexuosus* Rolfe.

TABLE 1

Comparison of *Wood 3444* (BOL) and *Schlechter 6484* (BOL) with the protologue of *S. angustifolius* Rolfe.

Protologue	<i>Wood 3444</i>	<i>Schlechter 6468</i>
1. "Sepals over $\frac{1}{6}$ " (4 mm) long"	Sepals 4 mm long	Sepals 8 mm long
2. "Sepals ovate or ovate-oblong"	Sepals narrowly ovate or ovate	Sepals lanceolate
3. "Lip . . . side lobes . . . obtuse"	Lip side lobes obtuse	Lip side lobes acute
4. "Spur . . . one quarter as long as limb" (=lip)	Spur 0,8 mm long, lip 3 mm long.	Spur 3 mm long, lip 7 mm long.

REPRESENTATIVE MATERIAL

Harrismith Platberg, 2 425 m, between rocks, flowers white and yellow, 10.I.1974, *Jacobsz 2523* (PRE); Bergville, Royal Natal National Park, Wit-zieshoek car park, 22.I.1977, *Stewart 1949* (NU); Cathedral Peak, 18.I.1965, *Schelp 7199* (BOL).

5. ***Schizochilus flexuosus*** Harv. ex Rolfe in Fl. Cap. 5.3: 92 (1912): Type: Liddesdale, *Fannin 56* (TCD!, holotype); Schltr. in Beih. Bot. Centralblatt 38: 97 (1921); Ross, Fl. Natal: 142 (1972).

Schizochilus pulchellus Schltr. in Beih. Bot. Centralblatt 38: 93 (1921): Type: Mt. Insiswa, January 1895, *Schlechter 6477* (B†, holotype; BOL!, PRE!, GRA!).

Schizochilus angustifolius Rolfe emend. Schltr. in Beih. Bot. Centralblatt 38: 97 (1921): Lectotype: Mt. Insiswa, January 1895, *Schlechter 6484* (B†, holotype; BOL!).

Schizochilus baurii Schltr. in Beih. Bot. Centralblatt 38: 99 (1921): Type: Mt. Bazija, 1 200 m, February, *Baur 630* (B†, holotype; BOL!, SAM!).

Plants slender, subflexuose, 50–250 mm tall; tubers testicular, 10–20 mm long, 7 mm in diameter; basal sheaths hyaline, obtuse, up to 20 mm long; leaves 10–30; the lower 6–20 basal, usually all the same length, linear to oblanceolate, semi-erect, flat to keeled, acute or shortly apiculate, 20–50 mm long, 2–8 mm wide; cauline leaves scattered on the scape, mostly narrowly lanceolate, acuminate, grading from the basal leaves into the floral bracts. *Inflorescence* dense, usually subcapitate, 20–40 mm long, 5–20–(30) flowered; ovary ca. 5 mm long; bracts as long as or longer than the ovary, narrowly ovate, acuminate, shallowly keeled; flowers large, ca. 5 mm in diameter, the sepals and petals white, the lip yellow. *Sepals* three-nerved, subequal; dorsal sepal galeate, elliptic, apiculate, 5–7 mm long; lateral sepals shallowly keeled, suboblique, lanceolate to narrowly ovate, acute, 6–9 mm long. *Petals* single-nerved, suboblique, narrowly ovate-rhomboid to lanceolate rhomboid, acute, 2,5–4,5 mm long. *Lip* 4–8 mm long, 3–4 mm wide; epichile deeply three-lobed, the central lobe ca. 2 mm long, the lateral lobes about half as long, lobes acute; hypochile much smaller than the epichile, disc calli rudimentary or absent; spur subcylindrical, subclavate, somewhat pendent, 3–4 mm long. *Anther* erect or somewhat angled, ca. 1,5 mm long.

DIFFERENTIAL DIAGNOSIS

This species is very closely allied to *S. zeyheri*, from which it can be separated by the white sepals. In the geographic overlap zone it may also be distinguished by the capitate inflorescences and basally clustered leaves. The floral structure distinguishes this group from the rest of the genus.

VARIATION

There is little variation that can be correlated to geography. Flower size and robustness vary, and depauperate specimens can have very few flowered, almost lax-looking inflorescences, associated with rather weakly developed basal leaves. *Devenish 853*, from Utrecht appears to be intermediate to *S. zeyheri*, with which it co-occurs. Flower colour is as for *S. flexuosus*, but the leaves and spur dimensions agree more with *S. zeyheri*.

BIOLOGY

S. flexuosus is restricted to the foothills and outliers of the Drakensberg between Maclear in the Eastern Cape, and Bergville in Natal, except for one collection from Ermelo in the Transvaal (*v.d. Merwe 1122*) and from Utrecht (*Devenish 853*). In this area it occurs between 1 500 and 2 500 m above mean sea level. Acocks (1975) described the vegetation of this zone as Veld type 44: Highland Sourveld. It is essentially a tussocked grassland, and occasionally a proteoid savanna (West, 1951; Adamson, 1938; Killick, 1963). The rainfall in this area ranges from 1 000 mm to 1 300 mm p.a., mostly in the summer, with

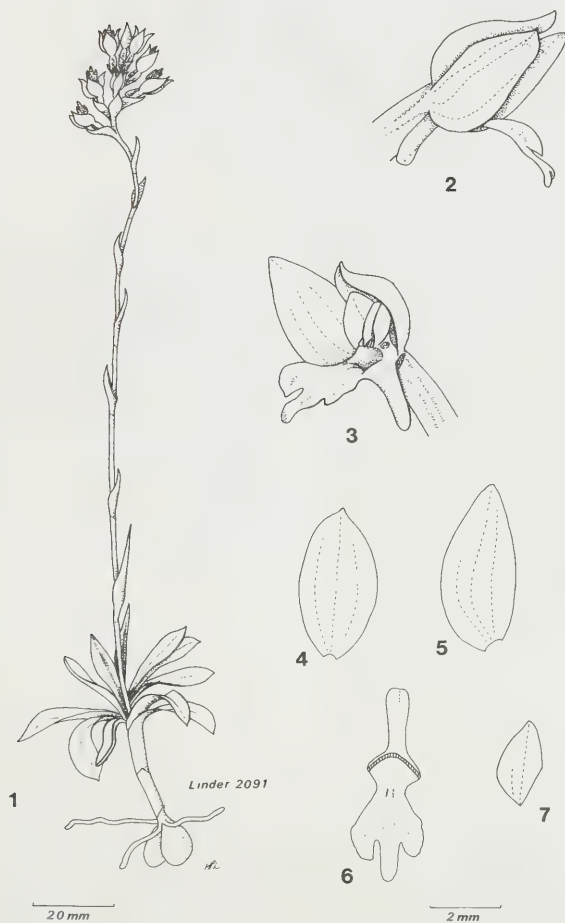


FIG. 15.

S. flexuosus Rolfe, from Linder 2091. 1. Whole plant. 2. Side view of flower. 3. Side view of flower with the lateral sepal removed. 4. Dorsal sepal. 5. Lateral sepal. 6. Lip. 7. Petal.

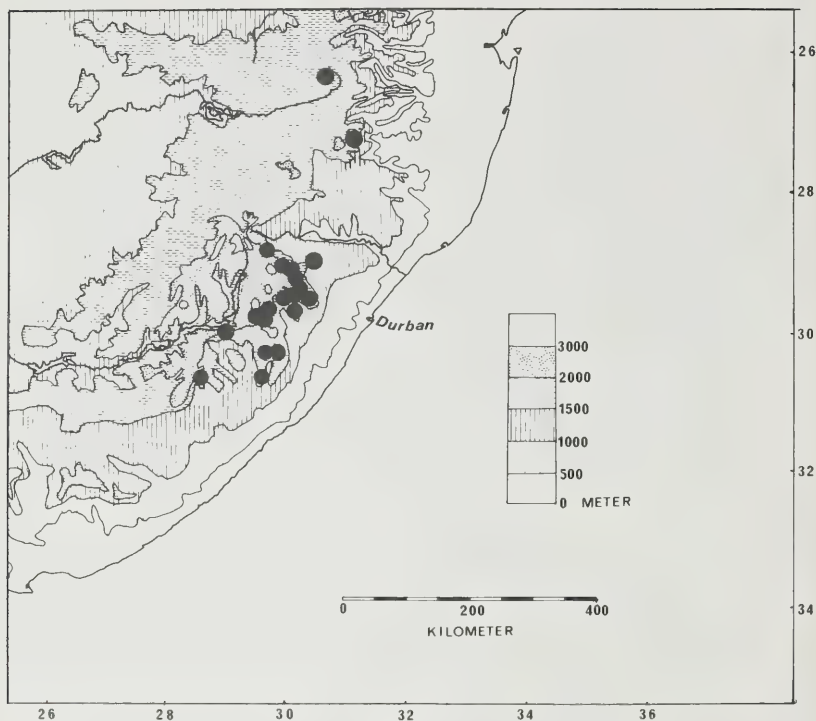


FIG. 16.
Distribution of *S. flexuosus* Rolfe

frequent snow in the winter (W.B. 29). Mists occur frequently. The substrate is usually Cave Sandstone, rarely Dolerite.

In this habitat *S. flexuosus* occupies damp grassland, often in shallow soil over bedrock. For a comparison of its habitat with that of other species of *Schizochilus*, see Figure 2. Populations are usually not very large, but the species appears to be fairly common. Scent faint, sweetish. Pollination biology is unknown. Flowering occurs in January and February.

NOMENCLATURAL NOTES

S. flexuosus was described in 1912 by Rolfe, from material housed at TCD. In 1921 Schlechter described three more taxa in this group—he had not seen any material of *S. flexuosus* Rolfe.

Baur 630, on which Schlechter based *S. baurii*, had been determined by Rolfe (1912) as *S. zeyheri*. Schlechter pointed out that his *S. baurii* was more closely related to *S. flexuosus* Rolfe than to *S. zeyheri*, but separated it on having larger flowers and differently shaped petals—both characters which are highly variable in *S. flexuosus*. *S. pulchellus*, based on material determined by Rolfe to be *S. gerrardii* appears to be a rather depauperate specimen of *S. flexuosus*. It has peculiarly narrow floral segments. Schlechter did not appreciate its affinity to *S. flexuosus*. *S. angustifolius* Rolfe emend. Schlechter is discussed above.

REPRESENTATIVE COLLECTIONS

Kokstad, I.1884, *Tyson 1600* (SAM!, GRA!, BOL!); Natal, Bushmans Nek, 2 750 m, 2.II.1976, *Hilliard & Burt 9021* (NU!); Bulwer, Natal, Marawaga Mt., 2 100 m, 31.I.1957, *Marais 1454* (PRE!).

6. *Schizochilus zeyheri* Sond. in *Linnaea* **19**: 78 (1847): Type: Winterberg Range, *Ecklon & Zeyher s.n.* (S!, holotype); H. Bol. in *Jl. Linn. Soc.* **25**: 205 (1889); Dur. & Schinz, *Consp. Fl. Afr.* **5**: 116 (1892); H. Bol., *Icones Orch. Austro-Afr.* **1** t.18 (1893); Rolfe in *Fl. Cap.* **5.3**: 90 (1912); Schltr. in *Beih. Bot. Centralblatt* **38**: 97 (1912); Ross, *Fl. Natal*: 142 (1972).
Brachycorythis zeyheri (Sond.) Reichb.f. in *Flora* **1867**: 117 (1867).
Platanthera zeyheri (Sond.) Schltr. in *Bot. Jahrb.* **20** Beih. **50**: 12 (1895).
Gymnadenia zeyheri (Sond.) Kraenzl., *Orch. Gen. Sp.* **1**: 561 (1898).
Schizochilus sandersonii Harv. ex Rolfe in *Fl. Cap.* **5.3**: 91 (1912): Type: Fields Hill, Natal, *Sanderson 564* (TCD!, syntype); near Durban, *Gerrard 2176* (TCD!, syntype); Inanda, *Wood 478* (? syntype, BOL!, SAM!); Schltr. in *Beih. Bot. Centralblatt* **38**: 98 (1912); Ross, *Fl. Natal*: 142 (1972).
Schizochilus strictus Rolfe in *Fl. Cap.* **5.3**: 91 (1912): Type: Klein Olifants-river, *Schlechter 4028* (K!, syntype; PRE!, BOL!, GRA!); Lydenburg, O'Neill's Farm, *Wilms 1397* (K!, syntype); Schltr. in *Beih. Bot. Centralblatt* **38**: 96 (1912); Dyer, *Fl. Pl. S. Afr.* **24** t.941 (1944); Ross, *Fl. Natal*: 142 (1972); Compton, *Fl. Swaziland*: 156 (1976).
Schizochilus trilobus Rolfe in *Fl. Cap.* **5.3**: 91 (1912): Type: Dargle Farm, *Fannin 8* (TCD!, holotype); Schltr. in *Beih. Bot. Centralblatt* **38**: 99 (1912); Ross, *Fl. Natal*: 142 (1972).
Schizochilus rehmannii Rolfe in *Fl. Cap.* **5.3**: 92 (1913): Type: Houtbosch, *Rehmann 5849* (? syntype); Lydenburg, Atherstone (? syntype; GRA!, SAM!)
Mac Mac, *Mudd* (? syntype); Schltr. in *Beih. Bot. Centralblatt* **38**: 100 (1912).
Schizochilus caffrus Schltr. in *Beih. Bot. Centralblatt* **38**: 94 (1912): Type: Bazijaberg 1 200 m, February, *Baur 631* (B†, holotype; NBG).
Schizochilus bolusii Schltr. in *Beih. Bot. Centralblatt* **38**: 95 (1912): Type: Swaziland, highveld between Mbabane and Oshoek, Jan. 1906, *Bolus 12321* (B†, holotype; BOL!, PRE!).

Schizochilus rudatisii Schltr. in Beih. Bot. Centralblatt **38**: 95 (1921): Type: Natal, Alexandra County, Fairfield, November 1905, *Rudatis* 159 (B†, holotype).

Schizochilus clavatus Schltr. in Beih. Bot. Centralblatt **38**: 96 (1921). Type: Elandspruitbergen, December 1893, *Schlechter* 3989 (B†, syntype); Belfast, February 1909, *Doidge* 551 (B†, syntype).

Schizochilus huttonae Schltr. in Beih. Bot. Centralblatt **38**: 99 (1921): Type: ? Johannesburg, *Hutton* 275 (B†, holotype; GRA!, PRE!).

Schizochilus woodii Schltr. in Beih. Bot. Centralblatt **38**: 99 (1921): Type: Van Reenen, 5 000–6 000', February 1904, *Wood* 9307 (B†, holotype; NBG!).

Schizochilus grandiflorus Schltr. in Beih. Bot. Centralblatt **38**: 100 (1921): Type: Swamps and streams at Dokin, *Bachmann* 416 (B†, holotype).

Schizochilus grandiflorus Schltr. var. *crenulatus* in Beih. Bot. Centralblatt **38**: 101 (1921): Type: Umkwani, *Tyson* 2605 (B†, syntype; PRE!, SAM!, GRA!) Port St. Johns, *Galpin* 3416 (B†, syntype; BOL!, PRE!).

Plants slender, rarely subflexuose, 150 to 600 mm tall; tubers testicular, 10–40 mm long; basal sheaths 1–3, hyaline or white, acute to obtuse; leaves 5–18; the lower 3 to 10 linear to very narrowly elliptical, basal or spread on the lower half of the scape, 40–140 mm long, 3–10–(17) mm wide, acute, semi-erect; the upper leaves lanceolate acuminate sheaths, grading into the floral bracts. *Inflorescence* lax, rarely dense, subcapitate, up to 100 mm long, and up to 30 flowered; ovary 5–10 mm long; bracts about as long as ovary, lanceolate, acuminate; flowers 4–6 mm in diameter, bright yellow, lip a richer yellow than the sepals. *Sepals* subequal, three-veined; acute; dorsal sepal subgaleate, narrowly elliptical, rarely apiculate, 4.5–11 mm long; lateral sepals somewhat larger, shallowly keeled, oblique, lanceolate, 4.5–11 mm long. *Petals* single-veined, flat or shallowly concave, suboblique, ovate to lanceolate, acute to subacuminate, 2.5–6 mm long. *Lip* 6–12 mm long, 4–6 mm wide; epichile deeply three-lobed, lobes narrowly ovate, very acute, central lobe up to 2 mm long, lateral lobes ca. 1 mm long; hypochile concave, much smaller than epichile; disc with three fleshy calli; spur straight, cylindrical, rarely subovate or subbifid or tapering; 2–6 mm long. *Anther* erect or angled, ca. 2 mm long.

DIFFERENTIAL DIAGNOSIS

This is the largest flowered species of *Schizochilus* with sepal length varying from 4–11 mm. From the closely related *S. flexuosus* it can be separated by the yellow sepals, and usually by the lax inflorescence. From all other species it can be distinguished by the spur 4–6 mm long, and by the very acute, narrowly ovate lip lobes.



FIG. 17.
S. zeyheri Sond. *Linder 1996* from Graskop (Haenertsburg form), *Linder 2004* from Belfast (Lydenburg form)

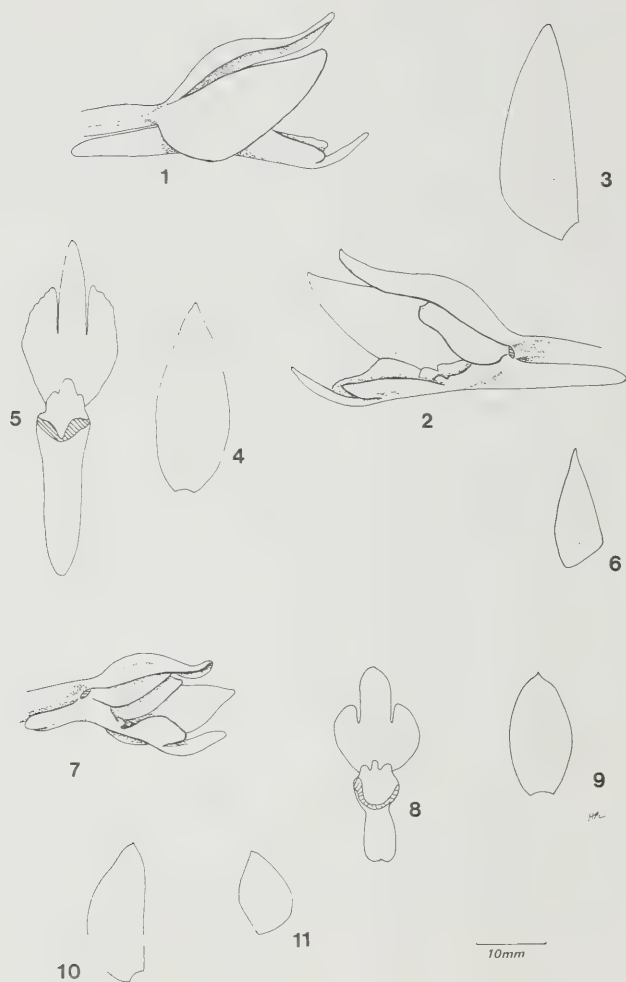


FIG. 18.

S. zeyheri Sond. 1 to 6 from *Hall 1150* (Port St. Johns, Pondoland Coast Form). 7 to 11 from *Linder 832* (Kaapsche Hoop, 2530 DB, Lydenburg Form). 1. Flower side view. 2. Flower side view with lateral sepal removed. 3. Lateral sepal. 4. Dorsal sepal. 5. Lip. 6. Petal. 7. Flower side view, lateral sepal removed. 8. Lip. 9. Dorsal sepal. 10. Lateral sepal. 11. Petal.

VARIATION

As can be seen from the description, this species displays a wide range of variation, most of which displays geographical patterns. Characters that vary are plant size, distribution of leaves, inflorescence shape, flower size and spur length. This variation forms the basis of the numerous species that have been segregated from this group by Rolfe (1912) and Schlechter (1921). The large amount of material collected over the last 50 years (the author studied 102 individual collections) reveals the patterns of variation clearly. Personal field studies have shown the range of variation found within single populations.

The variation among the geographical forms is summarised in Figure 19. Although the nodes are distinct, they are linked both by extreme forms within populations, as well as by intermediate populations. This appears to be a case of partial geographic differentiation. *S. lepidus* Summerh. also forms part of this group, it is discussed below. The geographical forms in South Africa have not been given formal status, as too many intermediate forms exist. The published names are matched with the forms. However, within one population individuals can frequently be found that would segregate into different forms. The geographical forms are mapped tentatively; see Figure 20. The geographical forms are as follows:

- (a) Haenertsburg form. Plants 400–600 mm tall, leaves scattered on scape, very narrowly lanceolate, flowers medium-sized, lateral sepals 5.5–7 mm long, spur 4–4.5 mm long.

S. rehmannii Rolfe

- (b) Lydenburg form. Plants small, 100–400 mm tall, leaves narrowly linear, mostly in a basal cluster, flowers small, lateral sepals 4–6 mm long, spur short, 3–4 mm long.

S. strictus Rolfe

S. clavatus Schltr.

- (c) Natal form. Plants variable in size, from 200–600 mm, leaves narrowly lanceolate, scattered on the scape, flowers medium-sized, lateral sepal 4–9 mm long, spur 4–6 mm long.

S. huttonae Schltr.

S. bolusii Schltr.

S. rudatisii Schltr.

S. trilobus Rolfe.

S. woodii Schltr.

- (d) Pondoland Coast form: Plants generally large, 400–800 mm tall, leaves lanceolate, scattered on the scape, flowers large, lateral sepals 7–11 mm long, spur 5–6 mm long.

S. sandersonii Rolfe

S. grandiflorus Schltr.

S. grandiflorus Schltr. var. *crenulatus* Schltr.

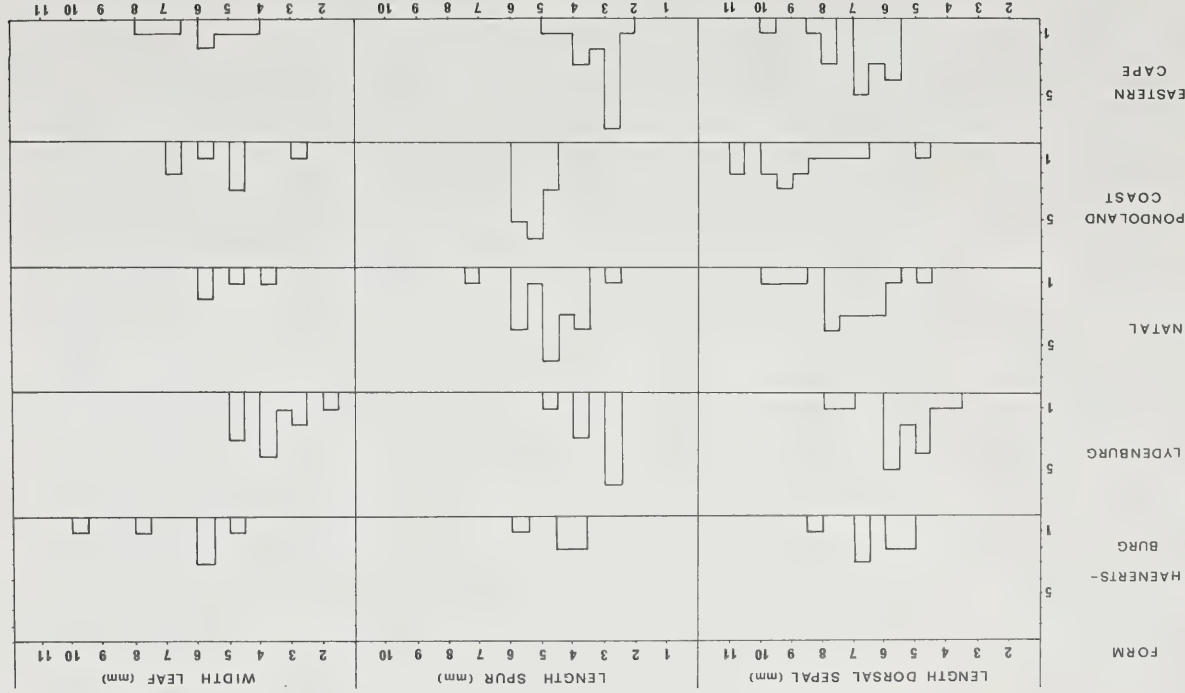


Fig. 19.
Variation in flower size (Dorsal sepal length, spur length and leaf width within and between the various forms of *S. zeyheri* described.

- (e) Eastern Cape form: Plants 100–300 mm tall, leaves lanceolate, in a basal cluster, inflorescence subcapitate, flowers medium-sized, lateral sepals 6–8 mm long, spur 2.5–4 mm long.

S. zeyheri Sond.

S. caffrus Schltr.

There appear to be some general tendencies in the variation: populations from more tropical areas have larger flowers (long spurs, longer lateral sepals), and taller plants. Basal leaves appeared to have evolved twice in the colder areas (E. Cape mountains, Belfast-Lydenburg area). They are not sympatric with the basal leaved *S. flexuosus* Rolfe.

NOMENCLATURAL NOTES

S. zeyheri was the first species described in the genus *Schizochilus*, and serves as the type of the genus. In 1912 Rolfe published 4 names, and in 1921 Schlechter described 8 names, that have been reduced to synonymy. Rolfe's species, on the material then available, must have seemed reasonable species—there is one in each geographical form. However, the same cannot be said of Schlechter's concepts. He did not allow for any variation in spur length, flower size, or tepal shape. I do not propose to treat Schlechter's work in detail—he generally lists the reasons for separating taxa.

I have not seen any type material of *S. rudatisii* Schltr. and *S. clavatus* Schltr. These taxa have been placed into synonymy here on the basis of the protologues, and the recorded type localities. Of *S. grandiflorus* Schltr. I have only seen material of var. *crenulatus* Schltr.—this leaves little doubt that var. *grandiflorus* could also be included in *S. zeyheri* Sond.

Of *S. rehmannii* Rolfe I have only seen a collection of Atherstone, which was unlabelled, but agreed with Rolfe's protologue. The material clearly falls into the present concept of *S. zeyheri* Sond., but doubt must remain as to whether these collections are syntypes of *S. rehmannii*.

BIOLOGY

S. zeyheri occurs in Acock's (1975) Veld types 1, 8, 57, 44a and b. Of these the last four are different types of sour grassveld. (North-eastern Mountain Sourveld, Highland Sourveld and Dohne Sourveld and North-eastern Sandy Highveld), and only the Pondoland and Natal Coastal forms occur in coastal forest and thornveld. Over the whole distribution range, rainfall varies from 800 mm p.a. (Belfast) to over 1 500 mm p.a. (Eastern Transvaal Escarpment edge). In altitude the species ranges from near sea level, to 2 000 m, *S. zeyheri* can thus tolerate a wide range of variation in the macro-environment.

Over the most of this distribution range it occurs in swampy localities, often associated with Cyperaceae. Populations studied in Acock's Veld type 1 occurred

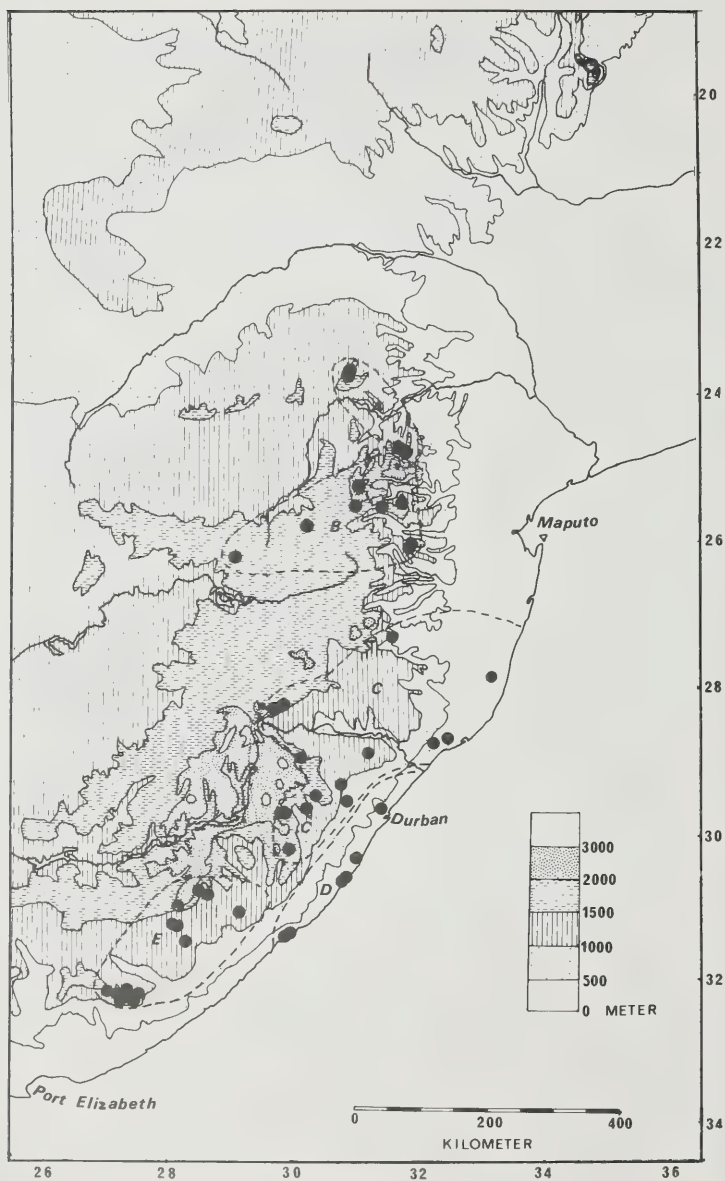


FIG. 20.
Distribution of *S. lepidus* Summerh. (○) and *S. zeyheri* Sond. (●)

in edaphic grasslands or swampy sites [*Linder* 799, Umgoye (2831 DC); *Linder* 823, Port St. Johns (3129 DA)]. Populations studied in sour grassland occurred mostly in secondary grassland, in seepages or swamps [i.e. *Linder* 2004, Belfast (2530 CA), *Linder* 1996, Graskop (2430 DD)], or in edaphic grassland in "dambos," [*Linder* 782, Magoebaskloof Hotel (2330 CC)]. However, in the Eastern Cape this species occurs mostly on damp to wet rock ledges, often facing the coast in the mist belt zone. At Maclear it occurs in sour grassland [*Linder* 2104, Macler (3128 BA)]. In the Hogsback and Katberg Mountains, and King William's Town, *S. zeyheri* also grows on rock ledges, often in depauperate macchia. Story (1951) records frequent snow and frost in winter, and only 60% of the rainfall in the summer for this area.

The habitats of *S. zeyheri* in Natal and Eastern Transvaal are compared with other species from those areas in Figures 2 and 3.

This species appears to be common throughout its distribution range. Populations generally range from 30 to several hundred individuals. In swampy habitats the degree of sociability is low, but on rock ledges it is high. The flowers are pleasantly sweet-scented, and nectar has been detected in the spur. Nothing is known about the pollination biology. Flowering occurs from December to February.

REPRESENTATIVE MATERIAL

Umkwani, Pondoland, X.1885, *Tyson* 2605 (SAM!, GRA!, PRE!); Thomas River, King William's Town I.1893, *Flanagan* 1689 (SAM!, GRA!, PRE!); Elandsberg, Stockenström, II.1886, *Scully* in *MacOwan & Bolus* 3178 (SAM!, GRA!); between Belfast and Dullstroom, 6.I.1979, *Linder* 2004 (BOL!, PRE!, K!); Forbes Reef, Mbabane, 19.I.62, *Compton* 31258 (NBG!, PRE!); Magoebaskloof Hotel, Haenertsburg, Pietersburg, 13.XII.1976, *Linder* 782 (BOL!).

7. *Schizochilus lepidus* Summerh. in Kew Bull. 14: 130 (1960): Type: Mozambique, Mt. Tsetsera, *Wild* 4471 (K!, holotype; SRGH!, PRE!).

Plants slender, rarely subflexuose, 150–250 mm tall; tubers testicular, 10–20 mm long, ca. 5 mm in diameter; basal sheaths 2, white to hyaline, obtuse, apiculate, up to 30 mm long; leaves 8–12, scattered on the scape; the lower 2 to 5 narrowly oblanceolate to narrowly elliptical, 30–80 mm long, semi-erect, acute; the remaining leaves more or less sheathing, lanceolate, acute, ca. 10 mm long. *Inflorescence* semi-dense, 20–80 mm long, 20–30 flowered; ovary 5–7 mm long; bracts as long as the ovary, narrowly ovate, acuminate; flowers ca. 5 mm in diameter, yellow. *Sepals* subequal, three-nerved, acute to apiculate, 4.5–6.5 mm long; dorsal sepal elliptical, concave; laterals somewhat longer than the dorsal sepal, oblique, lanceolate to narrowly ovate, shallowly concave. *Petals* one-nerved, obliquely ovate-rhomboid, acute, 2.5–4 mm long. *Lip* 4–6.5 mm long;

epichile three-lobed, lobes subacute, central lobe 1–2.5 mm long, lateral lobes ca. half as long; disc with three obscure calli; spur subclavate, 1.5–2 mm long. *Anther* ca. 1.5 mm long.

DIFFERENTIAL DIAGNOSIS

S. lepidus is very closely allied to *S. zeyheri*, and can be differentiated from it by the spur 1.5–2 mm long and subclavate.

BIOLOGY

This species is only known from the Chimanimani Mountains between Melsetter and Vumba, in Zimbabwe. In this area it occurs above 2 000 m, in grassland (Phipps 680) or in rocky ground (Wild 4471). Rainfall in the area is approximately 1 400 mm p.a., of which most falls in summer (Jackson, 1961).

No scent has been recorded. Flowering occurs from January to March.

This taxon is clearly very closely related to *S. zeyheri*, from which it is isolated geographically. Morphologically, there is only a single character difference. According to the "rule of thumb" proposed by Hedberg (1958), this should be formally treated at subspecific level. This usage has been followed by Rourke (1972) and Tölken (1977). However, if this taxon were to be treated as a subspecies of *S. zeyheri*, the South African material would have to be treated as ssp. *zeyheri* [Article 26 of the I.C.B.N. (1978)]. But this material shows an enormous range of variation, which could almost be regarded as five subspecies. Hall (1969) dealt with the same problem, and suggested that the logical conclusion would be the naming of a single subspecific taxon. With present usage, however, the only alternative is to treat the Chimanimani material at specific level.

REPRESENTATIVE COLLECTIONS

Chimanimani Range, Melsetter, near Martins Falls, 6.II.1958, Hall 377 (BOL!, SRGH!); Himalaya Range, Zimbabwe, 22.I.1955, Ball 478 (SRGH!).

18. *Schizochilus sulphureus* Schltr. in Bot. Jahrb. 53: 486 (1915): Type: Mt. Rungwe, Stolz 1075 (B†, holotype; K!); Schltr. in Beih. Bot. Centralblatt 38: 90 (1921); Summerh. in Fl. Trop. E. Afr. 156: 27 (1968); Williamson, Orchids S. Central Afr.: 35, 213 (1977).

Plants slender, subflexuose, 80–200–(300) mm tall; tubers testicular, 10–20 mm long, ca. 7.5 mm in diameter; basal sheaths usually 2, the outer hyaline, obtuse, the inner white, obtuse to acute, up to 20 mm long; leaves 6–14, scattered on the scape, generally 2–5 clustered basally, semi-erect to deflexed, narrowly lanceolate to linear, acute, 20–50 mm long, the upper leaves grading into the floral bracts. *Inflorescence* semi-dense, 20–60 mm long, 15–40 flowered; ovary ca. 5

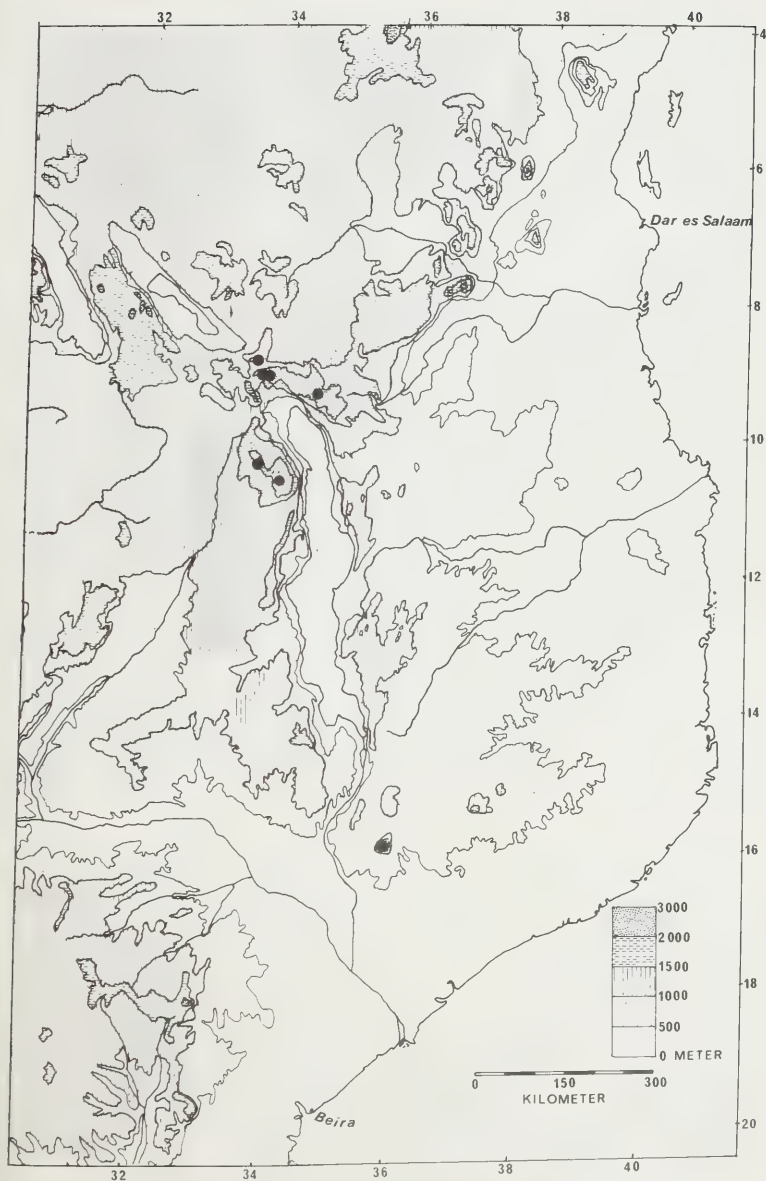


FIG. 21.
Distribution of *S. sulphureus* Schltr.

mm long; bracts slightly longer than ovary, narrowly ovate, acuminate; flowers ca. 4 mm in diameter, butter yellow, the petals somewhat paler than the sepals. *Sepals* subequal, three-nerved; dorsal sepal shallowly concave, elliptical to narrowly elliptical, obtuse to apiculate, 4,5–5,5 mm long; lateral sepals shallowly boat-shaped, suboblique, lanceolate, acute, 4,5–6,5 mm long. *Petals* single-nerved, oblique, rhombic-lanceolate, acute, 3–4 mm long. *Lip* 3,5–5,5 mm long, 1,5–2,5 mm wide; epichile three-lobed, central lobe subacute, ca. 1,5 mm long, lateral lobes obtuse, subobsolete, disc with three small calli; spur 0,8–1,2 mm long, curved towards the ovary. *Anther* ca. 1,5 mm long.

DIFFERENTIAL DIAGNOSIS

S. sulphureus is differentiated from the *S. zeyheri* group by the subobsolete lip lobes. The spur is shorter than 1,5 mm. The curved spur separates it from all other species of *Schizochilus*. It is the only species of *Schizochilus* that occurs north of the Zambezi.

BIOLOGY

This species occurs in the Afro-montane Zone (White, 1978) in the southern Rift Valley, between 1 800 and 2 500 m, mostly in secondary grassland. Recorded rainfall ranges from 1 750 mm to 2 000 mm on Mbeya (Kerfoot, 1964), 2 000–2 500 mm on Mt. Mulanje (Chapman, 1962), and from 1 000 to 2 500 mm on Nyika (Chapman and White, 1970). Snow does not occur, but mist and cloud are frequent. *S. sulphureus* is generally associated with rocky crevices or shallow soil over rocks. On Mt. Mbeya it occurs in the "Lithophytic Community" of Kerfoot (1964). Williamson (1977) records the habitat on Nyika Plateau as being "very wet montane grassland and wet peaty seepages on rock". On Mt. Mulanje this species was observed both in regularly burnt firebreaks, in mossy seepages over rock, as well as in moss on rocks in the proteoid scrub-land (Linder 2005). The pollination biology of *S. sulphureus* is unknown. Scent has been recorded as being slight. Flowering occurs in January and February.

REPRESENTATIVE MATERIAL

Malawi, Mt. Mulanje, Chilemba Peak, 12.II.1958, *Chapman 503* (K!, SRGH!, BOL!); Nyika Plateau, in rills, 10.II.1960, *Holmes 0203* (SRGH!, K!); Tanzania, Mbeya, rock clefts and crevices, 17.III.1960, *Kerfoot 1631* (K!).

9. *Schizochilus crenulatus* Linder, sp.nov.

Type: Graskop, Eastern Transvaal, 4.I.1979, *Linder 1995* (BOL, holotype; PRE, K).

S. zeyheri affinis inflorescentia laxa et sepalis 5–6 mm longis sed differt a calcaribus clavatis et callis filamentis, floribus albus nervatura malvinus differt, in saxonis humidus Transvaalensis orientalis crescit.

Plants very slender, sub-flexuose, 100–350 mm tall; tubers usually cylindrical, horizontal, two, rarely testicular; outer basal sheath very thin, hyaline, veins brown, apiculate; inner sheath white, apex green-tipped, acute, up to 40 mm long; leaves 5–6–(7); the lower 2–4 clustered basally, shallowly keeled, linear, acute, usually 70 but up to 100 mm long, ca. 4 mm wide; the remaining leaves scattered on the scape, grading from basal leaves into the floral bracts. *Inflorescence* a lax spike, nodding, 30–150 mm long, 6–25 flowered; ovary ca. 6 mm long; bracts half as long as the ovary, narrowly ovate, subacuminate; flowers about 5 mm in diameter, white with more or less mauve veins. *Sepals* subequal, three-veined; dorsal sepal galeate, narrowly oblong-ovate to oblong-ovate, apiculate, 5–7 mm long; lateral sepals shallowly keeled, suboblique, lanceolate to narrowly ovate, acute, often longer than the dorsal sepal, 5–7 mm long. *Petals* single-veined, subobliquely rhomboid, acute, curved over the anther and overlapping, 2.5–3 mm long and 1.5–2.5 mm wide. *Lip* 6 mm to 7 mm long, 3–4 mm wide; epichile three-lobed, the central lobe acute, ca. 2 mm long; the lateral lobes spreading or upcurved, rounded or truncate, usually crenulate, ca. 1 mm long; disc with a ridge of filamentous crests, hypochile relatively small, concave; spur straight, subclavate and bifid, 2–3 mm long. *Anther* erect, ca. 1.5 mm long.

DIFFERENTIAL DIAGNOSIS

This is the only species of *Schizochilus* with filamentous crests. It is readily distinguished from the other species with a lax inflorescence by the flower colour, and subclavate bifid spur.

ETYMOLOGY

The name “*crenulatus*” refers to the crenulate margins of the lateral lip lobes, a characteristic which occurs only rarely in *S. zeyheri* Sond., and not in any other species of *Schizochilus*.

VARIATION

Although several populations were studied, very little variation was observed.

BIOLOGY

S. crenulatus is only known from the sloping plateau around Graskop. Acocks (1975) described the vegetation of this region as Veld type 8: North-eastern Mountain Sourveld. The grassland is described as being very sour, dominated by *Themeda triandra*, and as being derived from forests. Rainfall in the area ranges from 1 540 mm at Mac Mac, to 1 800 mm at Graskop (W.B. 29). Altitude in the area ranges from 1 500 to 1 800 m. In this area *S. crenulatus* occurs at the edges of flat Black Reef Quartzite rock flushes, in damp to wet conditions, and often in moss. The substrate is very rarely deeper than 10 mm, there is thus only

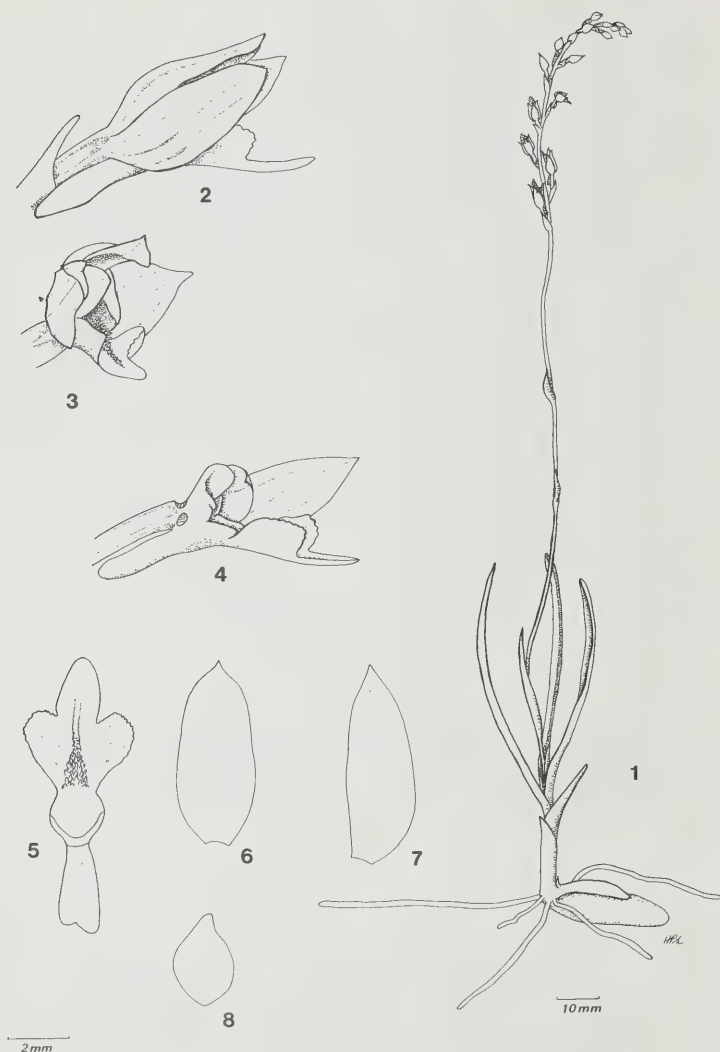


FIG. 22.
S. crenulatus Linder, from Linder 1995 (type). 1. Whole plant. 2. Side view of flower. 3. Front view of flower. 4. Side view of column and lip. 5. Lip. 6. Dorsal sepal. 7. Lateral sepal. 8. Petal.

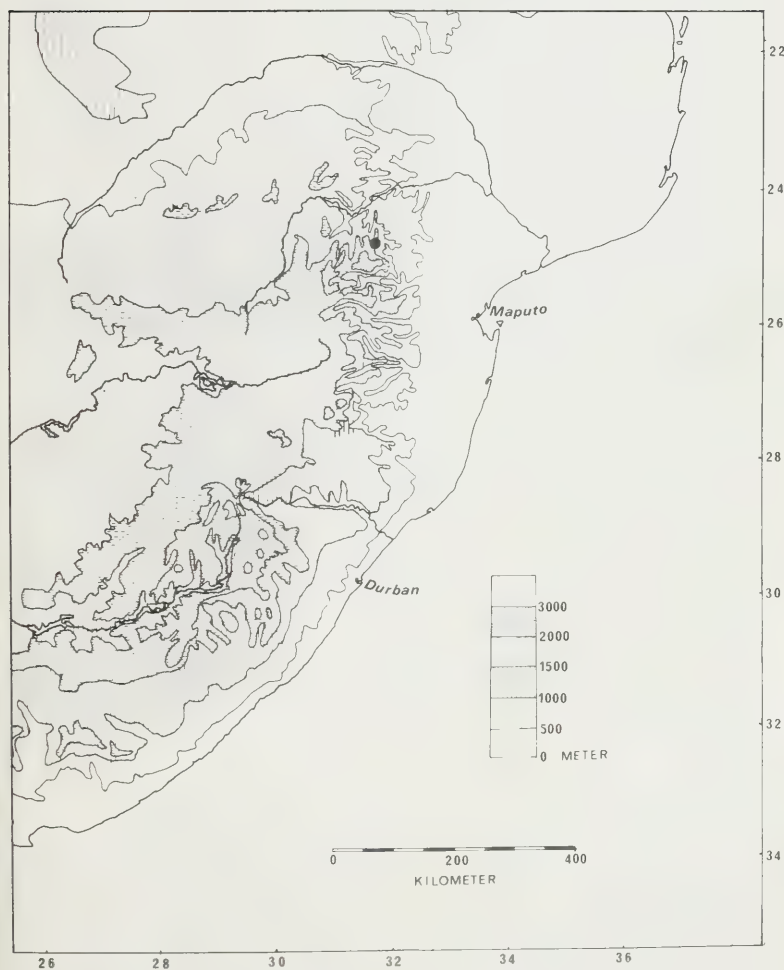


FIG. 23.
Distribution of *S. crenulatus* Linder

competition from mosses. The habitat is compared with that of other species of *Schizochilus* occurring in the area in Figure 3. Populations are large, ranging up to 200 plants. However, it is possible that there are very few populations, as these conditions only exist at the headwaters of streams. This species would have to be regarded as rare and vulnerable.

No scent or nectar could be detected, and regular seed-set occurred. The pollination biology is unknown. Flowering occurs from December to February.

NOMENCLATURE/HISTORY

This species was first collected by Galpin, probably in 1936. He sent living material to Mrs H. M. L. Bolus, in Cape Town, but it arrived in a bad condition, and Mrs Bolus thought that it might be a new species of *Cynorkis*. In February 1937 Galpin made another large collection, but the material was not studied. It is found in several herbaria under *Schizochilus indeterminavit*. In 1959 and 1961 Hall collected material, which was housed at BOL. Since 1975 several more collections have been made.

REPRESENTATIVE MATERIAL

Graskop, in moss on wet rocks, 4.II.1937, *Galpin 188* (BOL!, PRE!); Graskop, near Gods Window, on shallow rocks, 4.I.1979, *Linder 1998* (BOL!).

10. *Schizochilus lilacinus* Schelpe ex Linder, sp. nov.

Type: Graskop, Pilgrims Rest, in moist channel between two rocks, 2.XII.1937, *Galpin s.n.* (BOL!, holotype; PRE!).

Species insignis foliis 3–4 perangustis elliptibus, floribus albus nervatura roseus, callis filamentis; ab *S. zeyher* et *S. crenulato* sepalis lanceolatis 8–14 mm longis et petalis circa 3 mm longis differt; inter saxonis Transvaalensis orientalis crescit.

Plants slender, 200–350 mm tall; tubers testicular to cylindrical, up to 40 mm long; basal sheaths 2, the outer hyaline, obtuse, the inner white, acute, up to 40 mm long; leaves 3 or 4; the lower 2 or 3 near the base of the scape, semi-erect, shortly sheathing at the base, narrowly elliptical, acute, 40–100 mm long; the upper one or two leaves lanceolate, acuminate, erect, 20–40 mm long. *Inflorescence* semi-dense, up to 100 mm long, 3–25 flowered; ovary ca. 7 mm long; bracts somewhat longer than the ovary, narrowly lanceolate, acuminate; flowers ca. 10 mm in diameter, white or white with pink veins. *Sepals* subequal, three-nerved, lanceolate, acute, dorsal sepals 8–14 mm long, 2–3.5 mm wide; lateral sepals suboblique, 9–14 mm long, 2–3 mm wide. *Petals* single-veined, suboblique ovate, subacute, ca. 3 mm long. *Lip* 6–8 mm long, 2.5–3.5 mm wide;



FIG. 24.

S. lilacinus Schelpe ex Linder, from Galpin s.n. (type). 1. Whole plant. 2. Side view of flower with lateral sepal removed. 3. Side view showing column and lip. 4. Dorsal sepal, 5. Lateral sepal, 6. Lip. 7. Petal.

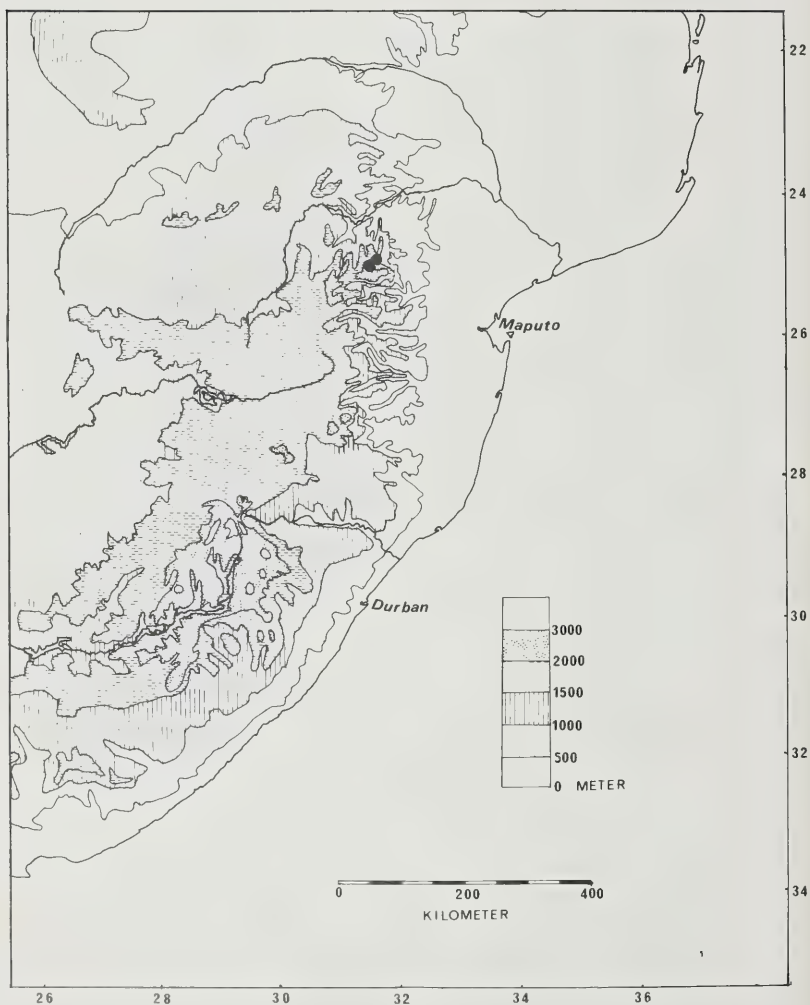


FIG. 25.
Distribution of *S. lilacinus* Schelpe ex Linder

epichile very obscurely three-lobed; central lobe 2.5–3.5 mm long, subacute; lateral lobes 0.2 mm long, upcurved; hypochile concave, ca. 2 mm long; disc with a small tuft of crests; spur deeply bifid, straight, 1.5–3 mm long. *Anther* ca. 2 mm long, straight.

DIFFERENTIAL DIAGNOSIS

This very distinct species can be recognised by the few large leaves, especially the 1–2 cauline sheaths; by the large flowers, by the petals only $\frac{1}{3}$ as long as the sepals, by the subobsolete lateral lip lobes and the bifid spur.

BIOLOGY

S. lilacinus has only been recorded from the Graskop-Lydenburg area, between 1 600 and 2 300 m above sea level. Acocks (1975) mapped the area as Veld type 8: North-eastern Mountain Sourveld. This is a secondary very sour *Themeda triandra* grassland. Rainfall at Graskop is about 1 600 mm p.a. (W.B. 29). There are no rainfall records for the summit of the Long Tom Pass. At the higher altitudes frost, and rarely snow, occurs.

In this general habitat, *S. lilacinus* occurs among rocks. A population studied on the Long Tom Pass was restricted to narrow ledges on a steep rocky slope, in soil ca. 40 mm deep, and occasionally in moss. The area could be described as damp.

No scent has been recorded, and the pollination biology is unknown. Flowering time is from October to December.

NOMENCLATURE/HISTORY

Like *S. crenulatus* this species was first collected by Galpin in 1937, but no attention was paid to the new collection. Only in 1963 did Schelpe re-collect it, this time near the summit of the Long Tom Pass. Here it was re-collected in 1964 by Lavranos.

The specific epithet refers to the pale lilac colour that occasionally occurs in the flowers.

REPRESENTATIVE MATERIAL

Summit Long Tom Pass, flowers white with longitudinal pink stripes, 2 100 m, 19.X.1963, *Schelpe s.n.* (BOL!).

HYBRIDS

The only hybrids reliably recorded are between *S. bulbinella* and *S. flexuosus*, from the summit of the Bushmansnek Pass, from Natal to Sehlabathebe in Lesotho (Hilliard & Burtt 8928). Both parental species were also recorded from the area (Hilliard & Burtt 8926, 8927). Field studies in the area revealed that the two

species were growing within metres of each other on a Cave Sandstone plateau, but the putative hybrids could not be recollected.

ACKNOWLEDGEMENTS

I would like to thank the following herbaria for the loan of material or the use of facilities: BOL, GRA, K, NU, PRE, S, SRGH, STE, TCD and Z. I wish to thank Prof. Schelpe, Dr Hall, Dr Rourke, the referee and several other people for valuable comments and interesting discussions. I acknowledge with thanks the Smuts Scholarship and C.S.I.R. Scholarships held during the study period; and I am most grateful to my father for deciphering and typing out the draft manuscript.

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APPENDIX 1. LIST OF SPECIMENS STUDIED.

The specimens are listed alphabetically according to the name of the collector. The figures in brackets refer to the number of the taxon in the text. Herbaria from which each collection has been studied are indicated by the letter codes of Holmgren and Keuken (1974). Hybrid collections are indicated by combinations such as (5–7).

Acocks 10085 (6) PRE; 13963 (4) PRE; 21909 (7) PRE; 34579 (6) PRE—*Atherstone* (7) GRA, SAM.

Ball 358 (1) K, SRGH; 478 (8) SRGH; 498 (2a) SRGH; 795 (9) K; 952 (1) BOL, SRGH—*Balleine Payn* 1 (7) GRA—*Barber* 31 (7) GRA, K—*Batten* (7) NBG—*Bauer* 630 (6) BOL, SAM; 631 (7) NBG—*Bayer* 339 (6) NU—*Bayer & McClean* 182 (5) PRE—*Bayliss* 304 (7) PRE; 2541 (7) NBG—*Beasley* 37 (2a) SRGH—*Beverley* 441 (6) NU—*Bews* 130 (7) NU—*Boardman* 239 (3) PRE; 255 (6) PRE—*Bolus* 12320 (2c) BOL; 12321 (7) BOL, PRE; (7) BOL—*Boughey* 549 (2a) SRGH—*Broad* (6) NU—*Bromhead* 58 (6) NU—*Bruce & Kies* 70 (7) PRE, SRGH—*Bruyns-Haylett* 37 (6) NU—*Buehrmann* (7) STE—*Bursell* in NU 7330 (5) NU—*Burt Davy* 1299 (7) BOL.

Campbell 1 (4) NU—*Chapman* 503 (9) K, SRGH—*Chase* 3601 (2a) SRGH; 4068 (2a) SRGH—*Codd* 6729 (7) PRE; 8174 (2c) PRE, SRGH; 9733 (7) PRE—*Coleman* 843 (7) PRE—*Collins* (7) PRE—*Compton* 19194 (7) NBG; 24745 (7) NBG; 31258 (7) NBG, PRE—*Culver* 76 (2c) BOL—*Cunliffe* (7) BOL.

Davies 859 (9) K—*Devenish* 599 (7) PRE; 849 (7) PRE; 853 (6) PRE—*Dodd* 8025 (7) PRE—*Dodge & Bottomley* (7) PRE—*Downing* 278 (7) NU, PRE—*Dyer* 374 (7) GRA.

Eastwood in PRE 14893 (7) PRE—*Ecklon & Zeyher* (7) S—*Edwards* (6) BOL.

Fannin 8 (7) TCD; 56 (6) TCD—*Fawkes* 347 (3) NBG—*Fischer* 1451 (2a) K, NU, PRE, SRGH—*Flanagan* 1687 (7) GRA, PRE, SAM; 2671 (7) PRE; 2766 (7) PRE, SAM—*Fouché* (6) STE.

Galpin 188 (10) BOL, NBG, PRE; 713 (2c) GRA, PRE, SAM; 1144 (2c) GRA, PRE, SAM; 3416 (7) BOL, NBG, PRE; 6841 (7) GRA, PRE; 9569 (7) PRE; 10209 (7) PRE; 11727 (6) BOL, PRE, SAM; 13189 (7) BOL, PRE; 14438 (2b) BOL, PRE; 14450 (7) BOL, PRE; 14558 (11) PRE; in PRE 11768 (6) BOL, PRE; in PRE 14360 (2b) BOL, PRE; in PRE 14263 (7) BOL, K; (10) PRE; (11) BOL; (11) BOL, PRE—*Gerrard* 1542 (4) TCD; 2176 (7) TCD—*Gerstner* 2619 (7) BOL—*Gibson* (3) NU; 03 (6) NU—*Gilfillan* in *Galpin* 7251 (7) GRA—*Graham* 50 (7) NU—*Grewcock* in PRE 27181 (7) PRE—*Grice* (6) NU—*Grosvenor* 777 (2a) BOL, K—*Gunn* (7) PRE.

Hall 377 (8) BOL; 611 (7) BOL; 631 (2b) BOL; 632 (10) BOL; 819 (4) BOL; 864 (7) BOL; 865 (10) BOL; 963 (7) BOL; 966 (7) BOL; 1150 (7) BOL—*Harrison* 82 (4) BOL—*Hart* (7) NU—*Haygarth* in STE 28 (7) STE; in Wood 9527 (5) GRA, NBG, SAM—*Henrici* 1414 (7) PRE—*Hilliard* 1135 (7) NU; 3049 (7) NU—*Hilliard & Burt* 3316 (4) NU; 4532 (9) K, NU; 6253 (9) NU; 7879 (6) NU, PRE; 7904 (7) NU; 8418 (4) NU; 8926 (6) NU; 8927 (3) NU; 8928 (3–6) BOL, NU; 9021 (6) NU—*Hoener* 1791 (6) NU—*Hofmeyr* in PRE 31700 (7) PRE—*Holmes* 0203 (9) K, SRGH—*Huntley* 786 (7) NU—*Hutton* 275 (7) GRA, PRE.

Jacobson 3814 (2a) K, PRE, SRGH—*Jacobsz* 2523 (5) NBG, PRE—*Jacot Guillarmod, Getliffe & Mzamane* 25 (6) PRE; 26 (3) PRE—*Jenkins* in PRE 6804 (7) PRE—*Johnstone* 597 (7) NU.

Kerfoot 1631 (9) K—*Kerfoot, Gooyer & Eastman* 31 (7) BOL; 33 (2b) BOL—*Killick* 232 (7) NU; 1324 (6) PRE; 2299 (5) PRE—*Killick & Vahrmeijer* 3588 (6) PRE; 4012 (6) PRE—*Kolbe* 74 (7) GRA—*Kolbe & Pegler* (7) GRA.

Lavranos 3915 (11) BOL; 9348 (7) PRE; 9360 (2b) PRE; 15264 (2b) K, SRGH—*Leighton* 2988 (7) BOL—*Lennon* 80 (2a) K, SRGH; 81 (2a) K—*Linder* 782 (7) BOL; 799 (7) BOL; 823 (7) BOL; 827 (7) BOL; 832 (7) BOL; 848 (7) BOL; 849 (2b) BOL; 850 (10) BOL; 937 (2b) BOL; 958 (6) BOL; 984 (3) BOL; 989 (6) BOL; 1007 (3) BOL; 1056 (7) BOL; 1071 (7) BOL; 1953 (4) BOL; 1960 (4) BOL; 1996 (7) BOL; 1997 (2b) BOL; 1998 (10) BOL; 1999 (2b) BOL; 2001 (11) BOL; 2002 (2b) BOL; 2004 (7) BOL; 2005 (9) BOL; 2049 (7) BOL; 2058 (7) BOL; 2077 (5) BOL; 2090 (3) BOL; 2091 (6) BOL; 2095 (3) BOL; 2104 (7) BOL.

MacOwan & Bolus 478 (3) BOL, GRA, SAM; 1378 (7) GRA, SAM—*Marais* 300 (7) PRE; 318 (2b) PRE; 1454 (6) PRE—*McBean* 74 (6) SRGH—*McClean* 230 (6) PRE; 642 (6) PRE; 693 (6) PRE—*McKeown* 74 (6) NU—*McLoughlin* 36 (7) BOL; 115 (9) PRE; 179 (3) BOL; 196 (3) BOL; 302 (7) BOL; 403 (7) BOL; 428 (3) BOL; 486 (6) BOL, PRE; 501 (3) PRE; 532 (7) BOL, PRE; in PRE 13667 (3) PRE; (3) BOL; (6) BOL—

Meeuse 10062 (2b) PRE—*Mogg* 13368 (7) PRE; 14671 (7) PRE; in PRE 31702 (2b) PRE—*Moll* 627 (7) NU, PRE—*Murray* 5 (7) PRE; 29 (7) GRA.

Newland 2 (10) PRE—*Nicholson* 855 (7) PRE; 939 (7) PRE; 1357 (7) PRE—*Norlindh & Weimarck* 4641 (2a) K; 4822 (2a) K; 4973 (2a) K.

Obermeyer 350 (2b) PRE—*O'Connor* 288a (7) NU; 315 (7) NU; 318 (6) NU; 335 (6) NU; 350 (7) NU; 355 (7) NU; 380 (7) NU.

Pegler 1431 (7) PRE; 1607 (7) PRE—*Phipps* 680 (8) SRGH—*Pienaar* (7) NU—*Prosser* 1764 (7) PRE.

Rabie 2 (7) PRE—*Ratty* in *Galpin* 7320 (7) PRE—*Rennie* 335 (6) NU; 517 (7) NU; 641 (7) NU; 730 (7) NU—*Reynolds* 2661 (11) PRE—*Richards* 7656 (9) K; 14250 (9) K; 14392 (9) K—*Richardson* 37a (2b) NU; 37 (7) NU—*Rogers* 11533 (7) GRA, PRE—*Royffe* 193 (7) GRA—*Rudatis* 577 (3) STE; 2388 (7) STE—*Rutgers* 7 (7) BOL.

Sanderson 564 (7) TCD—*Scheepers* in PRE 15022 (7) PRE; in PRE 31696 (7) PRE—*Schelppe* 136 (5) NU; 137 (6) NU; 7199 (5) BOL; 7672 (5) BOL; 7692 (5) BOL; (11) BOL—*Schlechter* 4028 (7) BOL, GRA, PRE; 6477 (6) BOL, GRA, PRE; 6482 (3) BOL, GRA, PRE; 6484 (6) BOL, GRA, PRE—*Schnitz* 7014 (3) PRE—*Scully* 1378 (6) BOL—*Shirley* (6) NU—*Sim* 252 (7) NU; 957 (7) GRA, NU, PRE, SAM; 20064 (7) PRE; (7) BOL—*Simon* 2323 (2a) K—*Smook* 644 (6) NU—*Smuts* 1063 (6) PRE—*Smuts & Gillett* 2328 (2b) PRE; 2338 (2b) PRE; 2383 (7) PRE—*St. Clair Thompson* 857 (9) K—*Stayner* 104 (7) GRA—*Stephany* 633 (6) BOL—*Stewart* 1949 (5) NU—*Stolz* 1075 (9) K—*Strey* 7193 (7) BOL, NU, PRE; 9515 (7) PRE—*Sutherland* (6) K—*Symons* 352 (6) PRE.

Taylor 263 (7) NU; 2045 (6) PRE—*Thode* in STE 3886 (7) STE; in STE 5745 (7) STE; in STE 8163 (7) STE—*Thompson* (7) NU—*Trauseld* 367 (6) NU, PRE—*Tyson* 1072 (3) BOL, GRA, SAM; 1600 (6) BOL, GRA, SAM; 2605 (7) GRA, PRE.

Van der Merwe 270 (2b) PRE; 281 (7) PRE; 1122 (6) PRE; 1535 (2c) PRE—*Van Jaarsveld* 1025 (10) PRE—*Venter* 5230 (7) PRE.

Wager in PRE 12499 (7) PRE; in PRE 31693 (7) PRE—*Walsh* 28 (6) NU—*Ward* 1120 (7) NU—*West* 4636 (2a) K, SRGH—*Whellan* 604 (2a) K, SRGH—*Wild* 4471 (8) K, PRE, SRGH; 4939 (2a) SRGH—*Williamson, Simon & Ball* 802 (9) K, SRGH—*Wilms* 1397 (7) K—*Wood* 478 (7) BOL; 3425 (7) BOL; 3444 (5) BOL; 3934 (6) BOL; 7735 (7) PRE; 9173 (7) NU; 9307 (7) NBG; 9527 (5) GRA, NBG, SAM; 10763 (5) PRE—*Wright* 2174 (6) NU—*Wylie* in PRE 34251 (7) NU, PRE.